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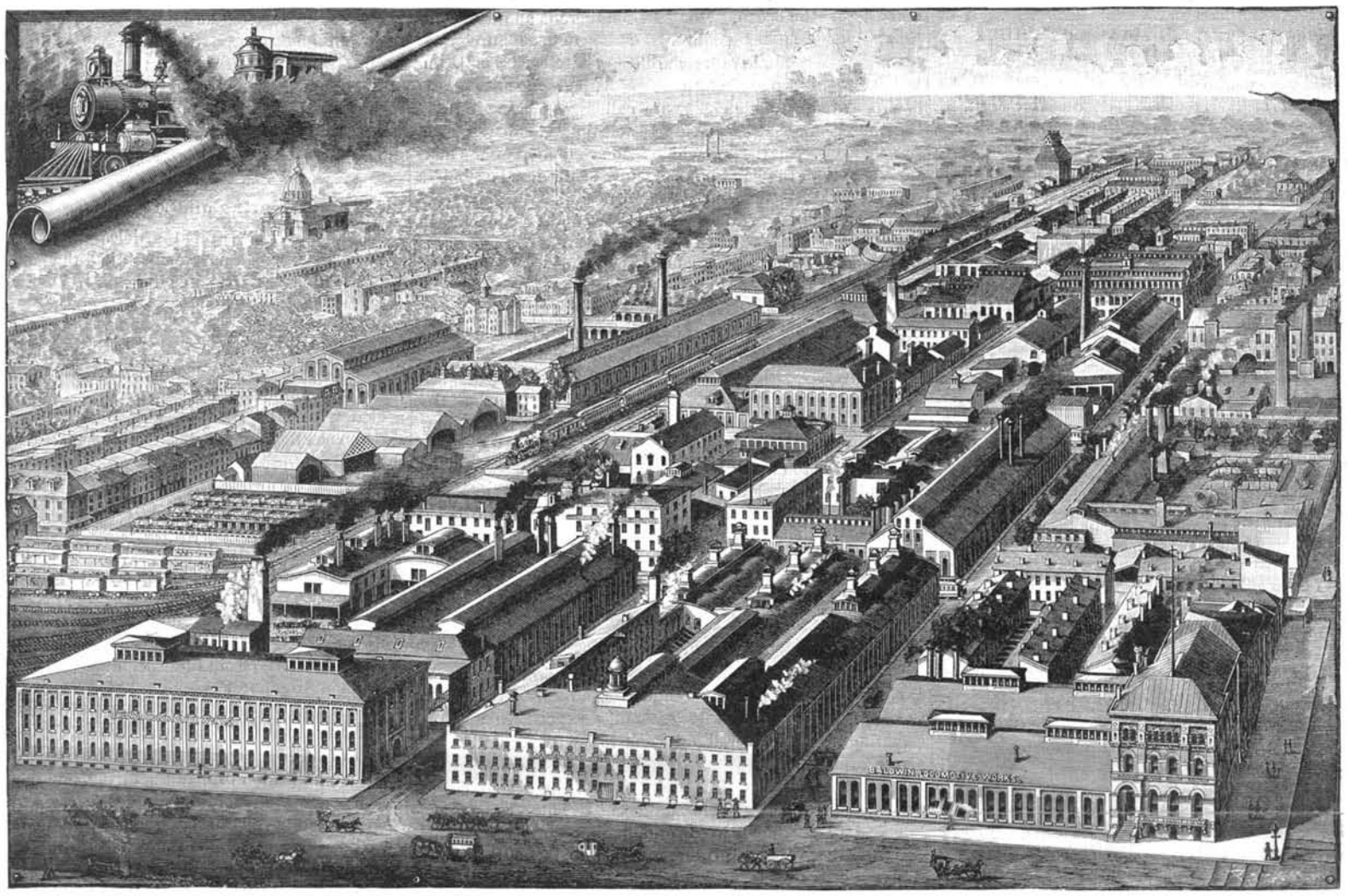
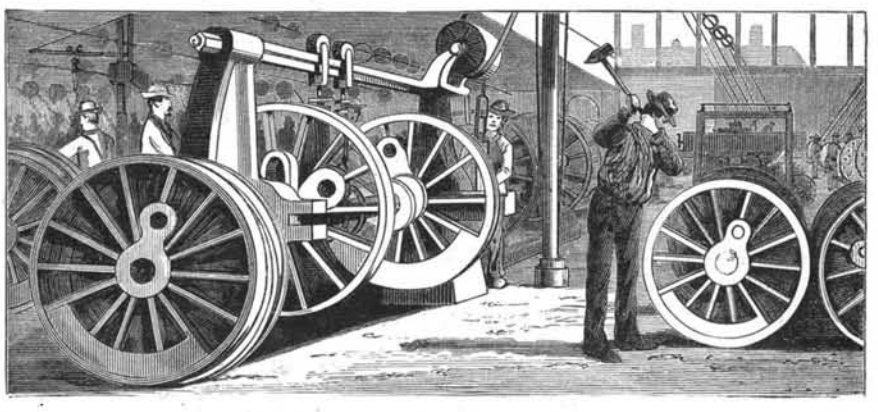
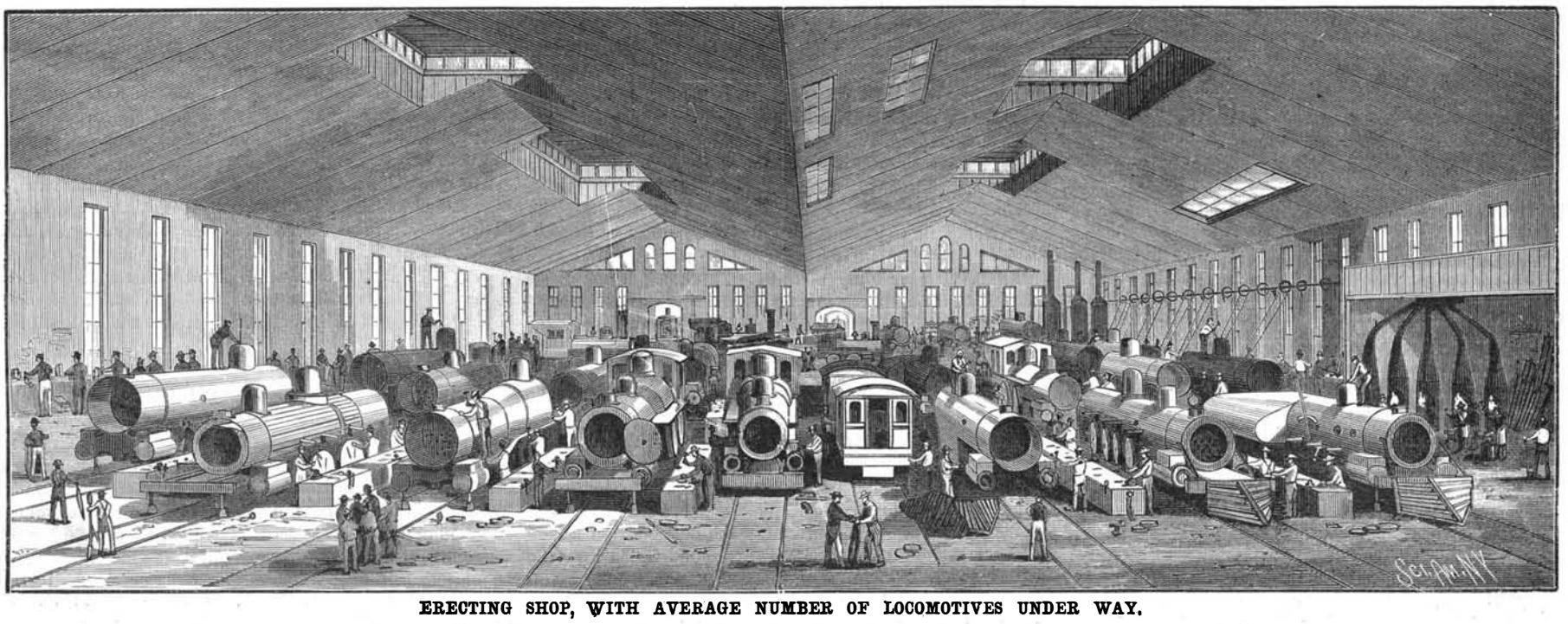


GENERAL VIEW OF THE BALDWIN LOCOMOTIVE WORKS.

POWER RIVETING IN THE BOILER SHOP.



FORCING THE DRIVING WHEELS ON THEIR AXLES.



ERECTING SHOP, WITH AVERAGE NUMBER OF LOCOMOTIVES UNDER WAY.

THE MANUFACTURE OF LOCOMOTIVES.—BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA.—[See page 339.]

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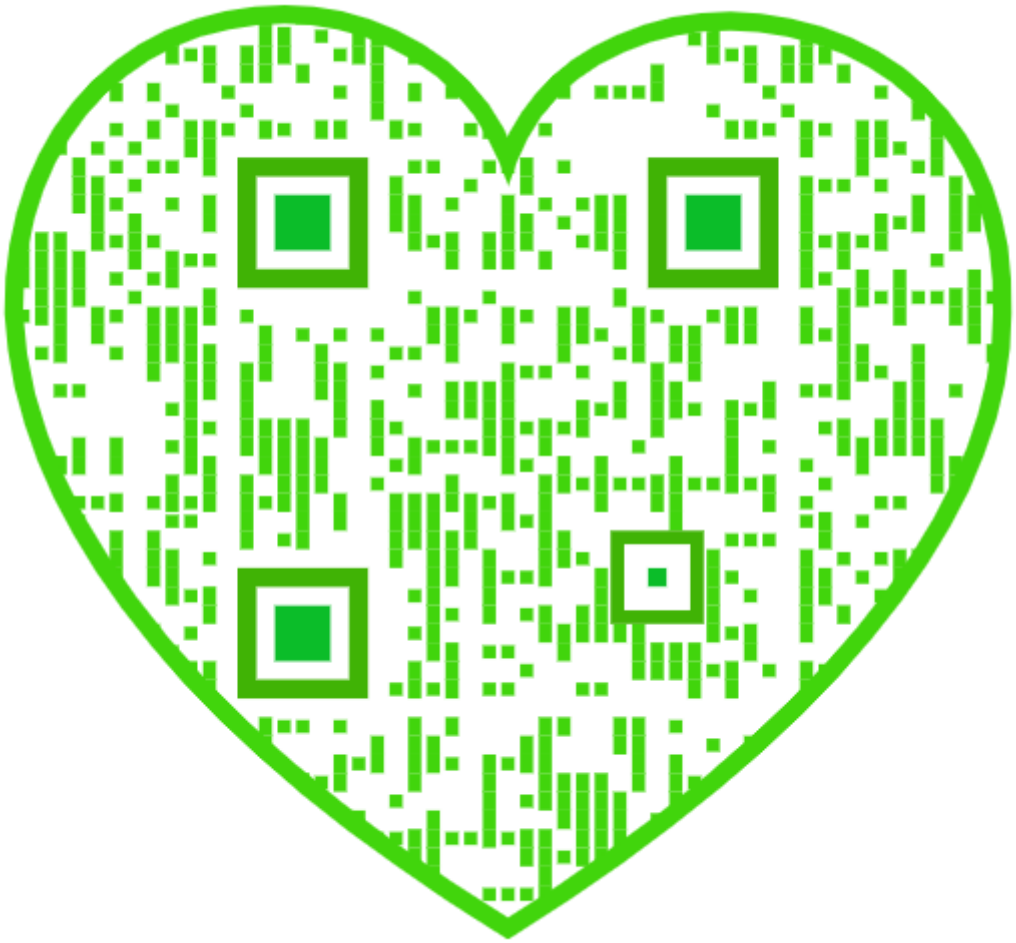

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AMERICAN CHAINS.

A writer in the *American Agriculturist* of May complains that his trace chains break, although he purchases at the best agricultural warehouses, and buys the best chains he can find. He attributes his experience and that of others, which he says are similar, to the use of "cheap American made chains." The inference suggested is that American made chains are not so good as others, *i. e.*, foreign made chains.

The best logging and trace chains are made by hand, each link being formed and welded on the horn of the anvil. They have been made so here for generations, and as the method is the same in foreign countries, and as good iron can be obtained here as there, no sufficient reason exists why American chains are or cannot be as good as others.

A hand welded chain of tough iron is no better for having come across the ocean. It is possible there is an inferior article of home make which this correspondent purchased; there is little actual value in cheap jewelry. Small, unwelded chains are made by machinery, and some heavy log chains and farm trace chains are called "machine made," the links being bent by machines, and the welds being made by belt drops. But these machine made chains are of less market value than the hand made chains, being rated at half a cent a pound less than those made by hand.

Some of the largest dealers in logging and farm chains in the eastern country state that they have few complaints of breakages of American made chains; they have far more from those of foreign make. The principal fault found with the home made chain is in the attempt to weld by machine drop instead of by hand, the machine weld showing a good surface from the die but not being reliable. The best chains are those which are hand welded. These chains seldom go to the market gurried over with coal tar; but frequently have been "tumbled" and polished so as to show their make.

Sometimes too much work is exacted from a chain; when iron is bent and welded, it is not responsible for more tensile strength than one-fourth of that of the rod when tested in a straight line. The fact is, American made chains are fully equal to those imported; and in many other productions of the hardy metals the American manufacturers lead the foreign producers.

Odd Coincidences.

In a recent issue of this paper we copied from Professor Richard Proctor's weekly publication *Knowledge* an item or two from the editor's strange experience and observation, related in serial numbers in his paper under the above heading.

In the last issue of *Knowledge* the distinguished editor and astronomer tells the vicissitudes he recently experienced in going from Knowle to Birmingham, and other incidents which have happened to him *en route* to the latter place. After reading the story as related by Mr. Proctor as follows, some persons on this side of the water might conclude that "*heedlessness*" would be a more appropriate heading than "*odd coincidences*," but the title the Professor chooses does not detract from his interesting account of his three journeys to Birmingham. He says:

If I believed in luck I might regard journeys in to Birmingham as unlucky for me. It may be remembered that a few months ago I described how oddly I was removed from my proper carriage and put into one not going to Birmingham. I was all right and alone; *two* passengers got into a wrong carriage; a second-class passenger was put into mine (first-class) because of a loose coupling; and at the next station a nervous station master, wired to about the two wrongly placed passengers, rushes to the wrong carriage, asks if we are for Birmingham instead of some other place, as he intended, and receiving "Yes" for reply, bundles us—the wrong passengers—into the carriage for that other place—so that I get to Birmingham much later than I intended, and my companion, who had a special appointment there, finds it useless to go there at all, and returns home.

Well, last week running into Birmingham from Knowle, I narrowly escaped "a real misfortune" as Mrs. Brown would say. I put down the bag containing the pictures for my lecture (the train was only to reach Birmingham five minutes before the lecture hour); go across a bridge to send off a telegram, and returning, enter train without my bag. I had not made such a mistake since February 3, 1881, when I let a train run out from Sacramento, Cal., with my lecture pictures. *That* time I was saved from shame and disaster by a rainstorm so violent that my lecture had to be postponed; and by next day kind friends in the eastward-bound train had sent back my pictures. *This* time, kind friends (one of them the same as in my Sacramento trouble) wired for my bag, and eventually it was brought in to me at the Birmingham Town Hall, just as I had got through the introductory part of my lecture.

This was rather an odd coincidence, but this was not the end of these Birmingham-nearing sorrows.

A few days later I am leaving Coventry for Birmingham, meeting my wife (from London) at the former station. "I will be careful," I remark to myself, "that no mistake of mine causes me any trouble." Vain hope! I see my heavier luggage labeled. On the arrival of the London train a lady and gentleman get out from the carriage in which my wife is sitting. They claim their smaller luggage, and my porter puts my precious lecture bag on a seat. I turn to put my umbrella in the rack, or perchance to salute my wife. "There was our error, boys," as old Belarius says. "Oh, you mistook; you should have seized your bag" (as Milton does not say), I might have said to myself. But, unconscious of disaster, I begin to inquire about the little ones at home. In the midst of these domestic cares suddenly I miss my bag. You guess what had happened? A wretched porter, sent back by my wife's fellow travelers to see that nothing was left, had opened the door the instant my back was turned, and had seized *my* bag as his lawful prey!

We wired from Stetchford and anon from Birmingham. Reply comes, "All luggage put out at Coventry claimed by Mr. B., of So-and-So Park." More urgent telegrams bring us news that So-and-So Park is seven miles from station. How again the same good friend (and somewhat more) who at Sacramento had sent back my bag, and at Knowle had helped to restore it to me, had to go to Coventry, while I lectured (*minus* some of my best pictures) at Birmingham; how Mr. B. had seen nothing of the bag; but how it turned up eventually along with his luggage, which had been sent unsorted to a lumber room at the top of the house, need not be told. The triple coincidence was complete, and I may hope to have no more trouble of the kind when nearing Birmingham. But I can understand how some folk get to imagine that particular places are unlucky to them.

Manufacturing and Mechanical Industries.

The numerous illustrated articles on manufacturing establishments, which have embellished the front page of this paper at intervals for some time past, have proved an acceptable feature to the home patron, and of special interest to the reader abroad.

The engravings of the various industrial works which have appeared in these columns are executed from sketches made on the premises by skilled artists, who have been connected with this paper for a long time—men selected for their mechanical knowledge as well as artistic attainments, the former acquirement being as necessary to insure good results in our class of work as the latter. This fact explains why the wood cuts in the SCIENTIFIC AMERICAN illustrate subjects so clearly as to enable the reader to form a pretty correct idea of the works represented, and with the description to gain a good understanding of the details of the manufacture.

Nearly one hundred manufacturing establishments, representing nearly as many different industries, have been pictured and described in these columns. In this series are illustrations of almost every kind of manufacturing and mechanical industry, and to most persons this class of subjects is both interesting and instructive, It is the desire of the publishers of this paper (seconded by the wishes of the readers) that the publication of manufacturing and machine making establishments be continued until every industry in this country shall have been represented in these columns.

To this end, managers of manufacturing establishments, engineering works, implement or other industrial enterprises, whose works have not been already illustrated in these columns, are invited to correspond with the editors of this paper.

Since moving to our large and more eligible offices, 361 Broadway, our facilities for executing orders for wood engravings are greatly increased, and manufacturers of all kinds of wood and metal working machinery and implements can have wood cuts of their productions executed in the best manner at the office of this paper, and if the machines possess novelty and utility over other machines in the same line or class, the editors will give place for their publication in the SCIENTIFIC AMERICAN. Patentees of useful and novel contrivances can have them illustrated and described in these columns, but it must be understood that neither old inventions nor poor cuts illustrative of new inventions can be admitted to these pages. It is only useful and interesting subjects represented by good wood cuts that are admissible.

A Law to Compel the Adoption of Improved Car Couplers.

By an act of the Legislature of Massachusetts, approved May 8, 1884, all new freight cars owned by railroad companies in that State, after March 1, 1885, are to be equipped with automatic or other safety couplers, approved by the Board of Railroad Commissioners, after examination and test thereof.

The commissioners will, on the 25th of September next, hear at their office, No. 20 Beacon Street, Boston, all parties desiring to set forth the merits of any safety coupler, and also any criticisms thereof by experts, and they will witness tests of such devices to be made in or near the city of Boston. The hearing will begin at 10 o'clock A.M. Records of the working of safety couplers in actual use for traffic are especially desirable.

Grape Seed Oil.

Grape seed oil is (according to the *Corps Gras Industriels*) used in Italy for purposes of illumination. The extraction is principally effected at Modena. It has also long been used for similar purposes in Germany and the Levant. Thirty-three pounds of seed yield about 13 quarts of oil (or about 18 per cent). The seeds of white grapes yield less oil than those of the dark variety, and young vines are said to be more fruitful in this respect than older ones. As to the French varieties, the Rossillar, Aube, and Herault seeds yield 2 per cent more than Bordeaux seeds. The color is a golden yellow, and the oil loses about 25 per cent in purification.

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ASPECTS OF THE PLANETS FOR JUNE.

VENUS

is evening star, and takes on her most beautiful aspect during the passage of the loveliest month in all the year. On the 3d, at noonday, she reaches her period of greatest brilliancy, and shines resplendent among the stars as their acknowledged queen. Her present high northern declination makes her an unusually conspicuous object. It will be no difficult matter to find her at noonday if her position is well known. A careful observation will bring her out as an intense white point in the sky. It will also be found that her light is so brilliant that objects illumined by her rays will cast perceptible shadows.

Her period of greatest brilliancy as evening star occurs thirty-six days before her inferior conjunction, and is accounted for in this way. The variations in her aspects and apparent magnitude are very great. At superior conjunction, or when beyond the sun, she is 160,000,000 miles distant from the earth, and presents the appearance of a small round disk, 10 inches in diameter. When nearest the earth she is only 25,000,000 miles distant, and if her illumined face were visible she would be more than 60 seconds in diameter. Between these two points she passes through various phases like the moon from full to new moon, approaching the earth all the time.

The nearer she comes the less is the portion of her illumined disk turned toward us, but her increasing size more than compensates for her lessened light, and her brilliancy steadily increases. When she is within 40 degrees of the sun, and the enlightened part of her disk is about one-quarter of the whole, her culminating point is reached, and she rejoices in her period of greatest brilliancy. This is the case on the 3d. After that time, though increasing in size as she approaches the earth, the gain in dimensions does not compensate for the lessened light, and the luster of the fair planet grows dim. These changes in the appearance of Venus may be watched and verified by interested observers, who will find the results more tangible than they are in many astronomical observations that are less easily attained and more minute.

Venus is now a superb object in the telescope, where she takes on the phase of the waning crescent. A good instrument will bring her out as large as the moon, her beautiful crescent rapidly lessening in size as she draws nearer to the great luminary in whose rays her lesser light will soon be absorbed. It is better to observe her in the daytime, for her light, unpleasantly dazzling on a dark sky, is softened by daylight into a pearly haze of indescribable beauty. The present opportunity should be improved for a telescopic view of the queen of the stars, for the coincidence of her high position in the north and her period of greatest brilliancy afford most favorable conditions for satisfactory observation.

The right ascension of Venus on the 1st is 7 h. 38 m.; her declination is 24° 9′ north; and her diameter is 35″.

Venus sets on the 1st about half past 10 o'clock in the evening; on the 30th she sets about half past 8 o'clock.

SATURN

is evening star until the 3d, when, following Neptune's example, he deserts the ranks and becomes morning star. On the 3d, at 4 o'clock in the afternoon, Saturn is in conjunction with the sun, passing apparently beyond him, and reappearing on his western side. Just as surely as he is lost to sight in the evening sky, just so surely will he soon become visible in the morning sky, pursuing his appointed path in the heavens, and holding in place his complex system of rings and moons in obedience to the same simple law by which in turn his huge mass is swayed by the sun. His coming circuit around the sun will be even more interesting than the one now completed, for he will be nearly at perihelion when it closes. His next conjunction occurs in June, 1885, and his perihelion in October of the same year, when he will be nearly 100,000,000 miles nearer the sun than he is at aphelion. His high northern declination will continue during the coming year, and his rings will be open to their widest extent.

Saturn, therefore, for two or three coming years will appear in his most propitious aspect. Observers will find the most favorable opportunity for studying this magnificent and complicated system. Astronomers will use their utmost endeavors to learn what the rings are made of, how they are held together, if they are really approaching the planet, and will seek to discover new satellites. Mr. Lockyer has recently made some interesting and satisfactory studies of the Saturnian rings, which will probably soon be made public.

If human beings, when they shuffle off this mortal coil, were permitted to choose another planet for an abode, there would be a great flocking to the planet whose beauty surpasses that of any other member of the system, whose sky is spanned by a golden arch, and adorned and illumined by eight moons, taking on all manner of phases.

The right ascension of Saturn on the 1st is 4 h. 48 m.; his declination is 21° north; and his diameter is 15·6″.

Saturn sets on the 1st about half past 7 o'clock in the evening; on the 30th he rises about 3 o'clock in the morning.

MERCURY

is morning star throughout the month. He reaches his greatest western elongation on the 12th, at 11 o'clock in the evening, being then 28° 19′ west of the sun. About that time he is in a favorable position for observation with the naked eye.

Mercury rises on the 12th shortly before half past 3 o'clock, and must be looked for soon after that hour. He will be 6 degrees south, and four times that distance west of the sun. The sky must be cloudless and the atmosphere clear, or the effort of early rising will be in vain; for under no other conditions will the "Sparkling One" deign to appear "under the opening eyelids of the morn." We give the middle of the period of visibility, but the planet may be seen for a week before and a week after the elongation. Mercury will be visible to the naked eye as morning star only once more during the year, in October.

On the 25th, at 6 o'clock in the evening, Mercury is in conjunction with Saturn, the planets being but one minute apart. Unfortunately, they are invisible at the time of conjunction, and when they rise on the next morning too near the sun for the observation of their near approach.

The right ascension of Mercury on the 1st is 3 h. 26 m.; his declination is 14° 43′ north; and his diameter is 10·2″.

Mercury rises on the 1st at a quarter before 4 o'clock in the morning; on the 30th he rises soon after half past 3 o'clock.

JUPITER

is evening star, and is a lovely object to behold in the western sky, where he reigns conjointly with Venus as leader of the bright congregation of glowing stars. He will no longer approach his fair rival, for after the elongation of Venus both planets are apparently moving westward, Venus outstripping her companion in the race. When the month closes she will disappear from view in her near approach to the sun, leaving him master of the field.

The right ascension of Jupiter on the 1st is 8 h. 16 m.; his declination is 20° 22′ north; and his diameter is 32″.

Jupiter sets on the 1st a few minutes before 11 o'clock in the evening; on the 30th he sets about a quarter after 9 o'clock.

MARS

is evening star, and is rapidly dwindling into insignificance as he travels from the earth and approaches the sun. It seems almost impossible that he can be the same grand and imposing planet that looked down from the sky at the opposition of 1877, when his two moons were discovered. But, in 1892, he will appear again in imposing size and martial aspect, for planets return from their wanderings to the same starting point in obedience to the same laws that hold the stars in their courses, compel millions of meteors to fall upon the earth every day, and determine the paths of the comets that visit the domain of our sun in their flight from star to star. Mars does nothing during the month but grow dim, travel slowly eastward in direct motion, and almost plunge southward.

The right ascension of Mars on the 1st is 10 h. 4 m.; his declination is 13° 20′ north; and his diameter is 6·4″.

Mars sets on the 1st soon after midnight; on the 30th he sets about 11 o'clock in the evening.

URANUS

is evening star. He remains almost stationary during the month, and is being rapidly overtaken by Mars. As Uranus is invisible, the approach cannot be observed with the unaided eye, and is not entertaining.

The right ascension of Uranus on the first is 11 h. 39 m.; his declination is 3° 4′ north; and his diameter is 3 6″.

Uranus sets on the 1st soon after 1 o'clock in the morning; on the 30th he sets at a quarter after 11 o'clock in the evening.

NEPTUNE

is morning star as well as Mercury, and Saturn joins them on the 3d. Therefore three of the sun's family are on his western side, anticipating his rising as morning stars, and four still remain on his eastern side as evening stars.

The right ascension of Neptune on the 1st is 3 h. 18 m.; his declination is 16° 30′ north; and his diameter is 2·5″.

Neptune rises on the 1st about half past 3 o'clock in the morning; on the 30th he rises about a quarter before 2 o'clock.

THE MOON.

The June moon fulls on the 8th at 49 minutes after 2 o'clock in the evening, standard time. The moon, the day after her first quarter, is in conjunction with Uranus. On the 20th the waning moon is in conjunction with Neptune, and on the 21st with Mercury and Saturn. On the 24th the new moon, one day old, is near Venus, on the 25th near Jupiter, and on the 28th near Mars and Uranus.

Measurement of Milk.

If the tests of noted cows were made known in quarts instead of pounds, the experiments would be more easily understood. It may be supposed that every farmer knows how many pounds of milk are contained in a gallon, but the common custom of measuring with the liquid system is not easily usurped, and we may safely assert that there are hundreds of farmers who read of the yields of cows, given as so many *pounds* of milk, and yet do not feel competent to state what that quantity should be in liquid measure. The method of weighing by the scales also misleads, as the quantity is usually seemingly larger than that from good dairy cows; but give the record in quarts, and every farmer understands the quantity at once.

Milk does not weigh the same under all conditions. A gallon of new milk should weigh eight pounds and eight ounces, or two pounds and two ounces per quart. It requires a pencil and paper for the farmer to reduce a certain number of pounds to the more familiar quarts, owing to the weight of a quart exceeding two pounds, and with a fraction to contend against. Again, skimmed milk weighs an ounce more to the gallon, or eight pounds and nine ounces, while cream weighs only eight pounds and four ounces. Buttermilk, however, weighs eight pounds and eight and a half ounces, and the fraction in that case is a bother. Few farmers read milk records closely when pounds are given, for they do not wish too much arithmetic in simple statements, although the weight system may be preferable at times; but give the production in quarts, and greater interest will be created in the tests, for the easier and more thoroughly understood the experiments, the better for those who make them and for those who are indirectly interested.—*The Farm, Field, and Fireside.*

A Feat of Telegraphy.

We have often heard of the wonderful line between this country and Teheran, the capital of Persia, a distance of 3,800 miles, but we scarcely realized the fact that good signals were obtainable through so great a length of wire until recently, when we availed ourselves of an invitation from Mr. W. Andrews, the managing director of the Indo-European Telegraph Company, to make a visit of inspection. It was between 7 and 8 on Sunday evening, April 13, when we reached the office. In the basement of an unpretentious building in Old Broad Street we were shown the Morse printer in connection with the main line from London to Teheran. The courteous clerk in charge of the wire, Mr. Blagrove, informed us that we were through to Emden, and with the same ease with which one "wires" from the City to the West End we asked a few questions of the telegraphist in the German town. When we had finished with Emden, we spoke with the same facility to the gentleman on duty at Odessa. This did not satisfy us, and in a few seconds we were through to the Persian capital (Teheran). There were no messages about, the time was favorable, and the employes of the various countries seemed anxious to give us an opportunity of testing the capacity of this wonderful line.

T. H. N. (Teheran) said, "Call Kurrachee," and in less time than it takes to write these words we gained the attention of the Indian town. The signals were good, and our speed must have equaled fifteen words a minute. The operator at Kurrachee, when he learnt that London was speaking to him, thought it would be a good opportunity to put us through to Agra, and to our astonishment the signals did not fail, and we chatted pleasantly for a few minutes with Mr. Malcom Khan, the clerk on duty. To make this triumph of telegraphy complete, Agra switched us on to another line, and we soon were talking to a native telegraphist at the Indian Government Cable Station, Calcutta. At first the gentleman "at the other end of the wire" could not believe that he was really in direct communication with the English capital, and he exclaimed in Morse language, "Are you really London?" Truly this was a great achievement. Metallic communication without a break from 18 Old Broad Street, London, to the telegraph office in Calcutta! Seven thousand miles of wire! The signals were excellent, and the speed attained was not less than twelve, perhaps fourteen, words per minute.—*Telegraphist.*

The Magnetic Polarity of Iron.

Captain John Hayden, of Bath, Me., author of "The Requisite Nautical Assistant," writes us that as long as forty years ago he practically tested, on shipboard, the influence of upright iron bars or masses of iron on the needle. He says: "Iron rods or bars, in a horizontal position, exert but little force on the compass, but the same amount and form of iron placed vertically produce an immense effect on the needle. The iron rod immediately becomes magnetic when placed in a vertical position, its magnetism increasing with the length of time it so remains, although it manifests no magnetism when parallel with the horizon. This effect on iron is most marked when the rod is held or placed in the magnetic meridian, and in the direction of the tipping needle, which is in this country with the bottom end swung to the north about thirty degrees from the perpendicular."

Remedy for Phthisis.

Aluminum and its compounds are affirmed by Dr. Pick, in the *Pharmaceutical Journal,* to constitute a most effective remedy against pulmonary tuberculosis, this opinion being based on experiments upon rabbits as well as on clinical observations. In one case, where infiltration of the apices of the lungs had occurred, removal of the lesion and all the morbid symptoms is said to have followed the administration of aluminum in the following form: Metallic aluminum, 8 grammes; aluminum hydrate, 5 grammes; calcium carbonate, 5 grammes; gum tragacanth in sufficient quantity—divided into sixty pills, one pill being taken three times a day.

A Highly Elevated Railroad.

The Pike's Peak Railway, which will be in operation next year, will be the most notable piece of track in the world. It will mount 2,000 feet higher than the Lima & Oroya Railway, in Peru. It is now in operation to a point over 12,000 feet above the sea level. The entire thirty miles of its length will be a succession of complicated curves and grades, with no piece of straight track longer than 300 feet. The maximum grade will be 316 feet to the mile, and the average grade 270 feet. The line will abound in curves from 500 to 1,000 feet long, in which the radius changes every chain.

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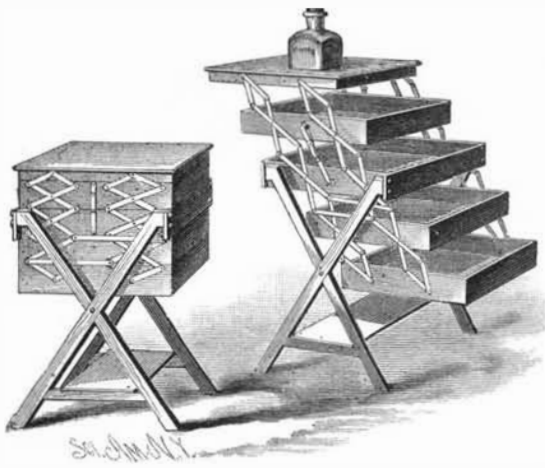
CHEST OF DRAWERS.

The accompanying illustration represents an invention recently patented by Mr. Abe L. Adams, of 264 Main Street, Bridgeport, Conn., in which the frames for the drawers to slide in are connected together at the ends by two systems of lazy tongs, thereby permitting the frames to be extended either vertically or as shown in one of the figures.

The two systems of lazy-tongs are connected by parallel bars that stay them laterally. The frames can be secured



ADAMS' CHEST OF DRAWERS.

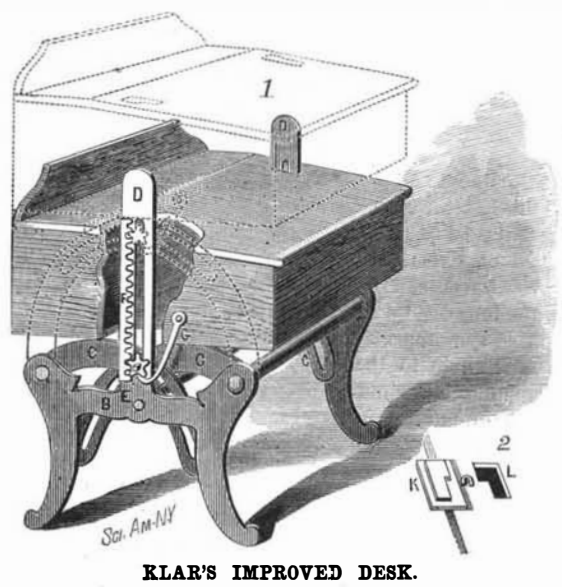
in an extended position by means of a latch. The middle frame serves as a fulcrum on which the others can swing into an inclined position. The frames may be placed in a chest or case consisting only of a bottom, ends, and removable top, the sides being closed by the front and back edges of the drawers; or a support may be formed of braced cross legs, as indicated in the engraving.

The drawers when loaded balance each other, and may be adjusted in open and closed positions, and, by attaching the frames to every alternate cross joint of the lazy-tongs, the drawers can be adjusted further apart in order to be more easily accessible. The various applications of this useful device and the ease with which it may be operated will be readily understood.

IMPROVED DESK.

The permanent bench is made in any approved form, and is of a suitable height to support the desk or table top sufficiently low for use by a person sitting in a chair. On the center of each cross bar, B, is fixed a slotted standard, D, one side of which is toothed, as shown at F. The standards extend through openings in the desk top, which act as guides, and rise about as high as the top is to be elevated. To the top of each leg is pivoted a curved slotted arm, C, thereby forming a pair of arms at each end. A shaft, extending from end to end of the table, passes through all the slots, and gears at each end by a pinion, E, with the toothed racks on the standards, so that by turning the shaft the desk may be raised or lowered. A hook pawl, engaging with one of the pinions, holds the desk at the desired height. When the desk is raised to the highest position, its top extends a little above the ends of the standards, so that the openings in the top can be closed by hinged covers, as shown in Fig. 2. The dotted lines show the desk in the raised position. The parts may be quickly disconnected, and packed in a small space for transportation.

Additional particulars regarding this invention may be



KLAR'S IMPROVED DESK.

obtained from the patentee, Mr. Jacob Klar, of Rodney, Miss.

DR. V. POULAIN believes that the reason that cow's milk so often disagrees with children is to be found in the fact that cane sugar is used to sweeten it. He says that for thirty-three years he has used the sugar of milk with the best results.

Dry Houses vs. Damp Houses.

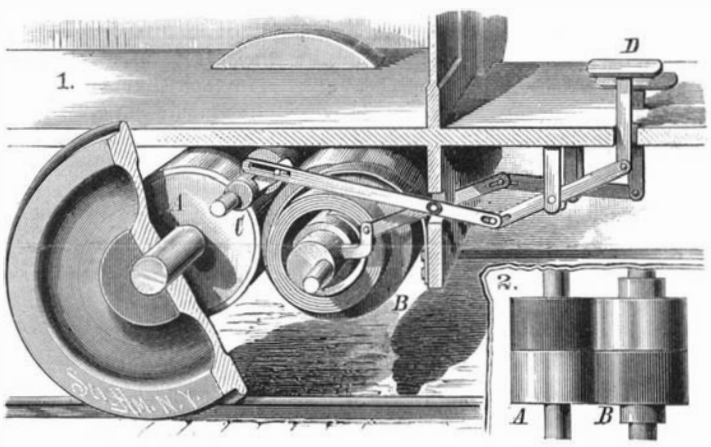
The importance of selecting dry locations for a residence is very aptly illustrated in the following extract from an address by Prof. R. C. Kedzie before the Michigan Tile Makers' Convention:

Two brothers in Vermont, of strong and vigorous stock, and giving equal promise of a long and active life, married wives corresponding in promise of future activity. They had both chosen the healthiest of all callings—farming. One of the brothers built his house in an open and sunny spot where the soil and subsoil were dry; shade trees and embowering plants had a hard time of it, but the cellar was dry enough for a powder magazine. The house in all its parts was free from every trace of dampness and mould; there was a crisp and elastic feel in the air of the dwelling; the farmer and all his family had that vigorous elasticity that reminds one of the spring and strength of steel; health and sprightly vigor were the rule, and sickness the rare exception. The farmer and his wife, though past threescore, have yet the look and vigor of middle life.

The other brother built his house in a beautiful shady nook, where the trees seemed to stretch their protecting arms in benediction over the modest home. Springs fed by the neighboring hills burst forth near his house, and others by his barns; his yard was always green even in driest time, for the life blood of the hills seemed to burst out all about him in springs and tiny rivulets. But the ground was always wet, the cellar never dry, the walls of the room often had a clammy feel, the clothes mildewed in the closets, and the bread moulded in the pantry. For a time their vigor enabled them to bear up against these depressing influences; children were born of apparent vigor and promise, but these, one by one, passed away under the touch of diphtheria, croup, and pneumonia; the mother went into a decline and died of consumption before her fiftieth birthday, and the father still lives, but is tortured and crippled by rheumatism.

CAR STARTER.

In the device shown in the engraving the power employed to stop the car is stored up in springs, and utilized for starting the car. Arranged on each car axle is a friction drum, A, directly in front of which is a second friction drum, B, fitted loosely on a shaft that has eccentric pivots in bearings in the frame, and is connected by levers with a foot treadle located above the platform of the car, so that pressure on the treadle will press the drum, B, on the drum, A. By this means the spring attached to the drum, B, is wound up and made to act as a brake to stop the car. The small roller, C, is fitted loosely on an eccentric shaft, and is connected by levers with a treadle. When this treadle is pressed down the roller, C, is made to bear alike on both drums. The springs turn the drum, B, the reverse of the way it was turned by the drum, A, and, driving back on the drum, A, through the roller, C, will start the car forward. Care must be taken to press the roller upon the drums before the foot is removed from the brake treadle, in order to keep the spring under tension. The drums are so constructed that paper on one will run against iron on the other, as indicated in Fig. 2.



WILSON'S CAR STARTER.

This invention has been patented by Mr. John Wilson, whose address is P. O. Box 243, Chicago, Ill.

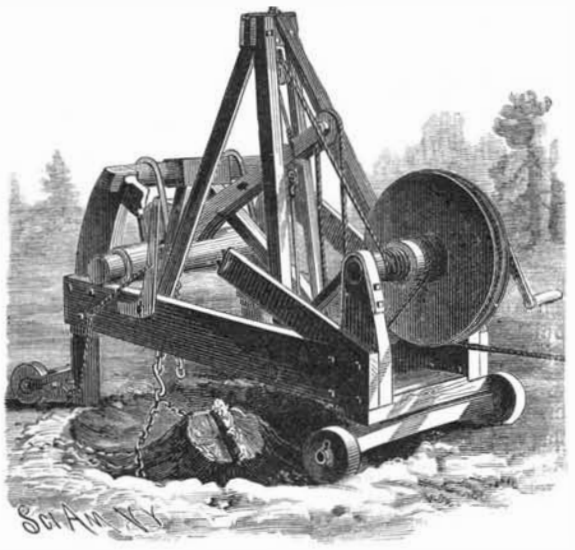
A Chance for the Ingenious.

In the May number of the *American Meteorological Journal*, a new monthly periodical published at Detroit, Mich., the editor, Prof. M. W. Harrington, suggests the need of the following invention:

"Some one should now invent some mechanical and continuous register of cloudiness. The present eye-estimates are unsatisfactory, and when we get ready to make up the earth's accounts of receipts and expenditures of heat, we must have some more trustworthy record of cloudiness. The sunlight-recorder sometimes employed is defective in that it registers only direct sunlight and gives no indications of clouds at night, or even daylight clouds which do not directly intercept the sun's rays. It bears about the same relations to the nephelometer which we should have that the sun-dial bears to the clock. There is a notable difference in the radiation of clear sky and clouds, and this must be capable, in some way, of instrumental measurement and record."

STUMP PULLER.

The engraving shows a stump puller for which letters patent have been granted to Mr. Charles A. Blume, of Union City, Indiana. The rear end of a strong frame is mounted upon two legs that are provided with caster wheels which

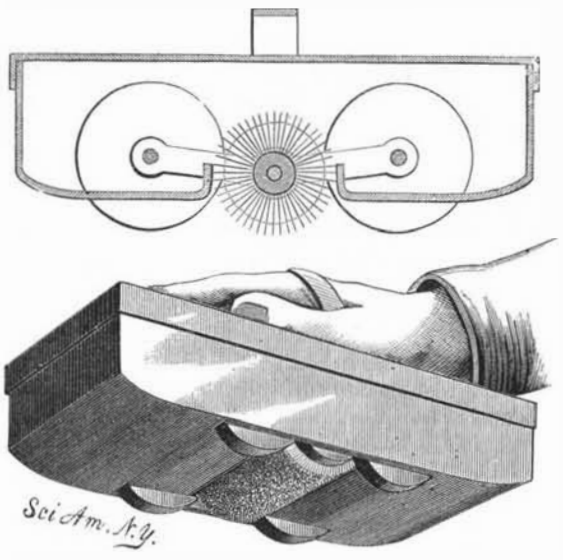


BLUME'S STUMP PULLER.

shift up and down, in order that the legs may rest upon the ground while the stump is being pulled, and upon the wheels when the machine is to be drawn over the ground. The front of the frame is supported upon an axle furnished with wheels. Extending across the top of the rear end part is a beam from which hang stirrups to support the center of an axle having pivot bearings at the end of the side timbers. Resting on this axle is the pulling lever, which has a semi-circular block to work the chain—the block being placed a little eccentric to the axle for drawing up the chain quickly at the beginning, and for increasing the pulling effect when the greatest resistance occurs. The free end of the lever is suspended by a cord and pulley from a derrick mounted on the frame for raising the lever to lower the chain for hooking on to the stump. A strong rope, secured to the lever extends down around a pulley on a cross beam, thence around a pulley in the end of the lever, then under a roller supported in the frame, and then around the axle of a powerful windlass. On this axle is a drum about which is wound the rope to which the horses are attached. The axle is also provided with a hand crank for unwinding the main rope and winding up the other when the lever is to be set again. This construction gives great pulling power, since the force applied passes through, first, the windlass, second, the cord and pulleys, and then the lever.

HORSE CLEANER.

A sheet metal box, having a cover provided with a handle, has a transverse slot in the bottom. In the slot is a brush mounted on a shaft, on each end of which is a small wheel, against which rest two larger wheels mounted on shafts journaled in the sides of the box; these shafts carry links, at the middle of which the brush shaft is journaled. The rims of the wheels are made of rubber. The cleaner is held in the same way as the common horse brush, and as it is



FARR'S HORSE CLEANER.

rubbed over the animal's skin the large wheels are revolved by friction, as they project slightly from the bottom of the box. This imparts a rapid motion to the small wheels, and the revolving brush sweeps the dust, etc., into the box, from which it can be removed after the cover has been taken off. Our engraving shows a perspective view and a sectional elevation.

This invention has been patented by Mr. Eugene M. Farr, of North Muskegon, Mich.

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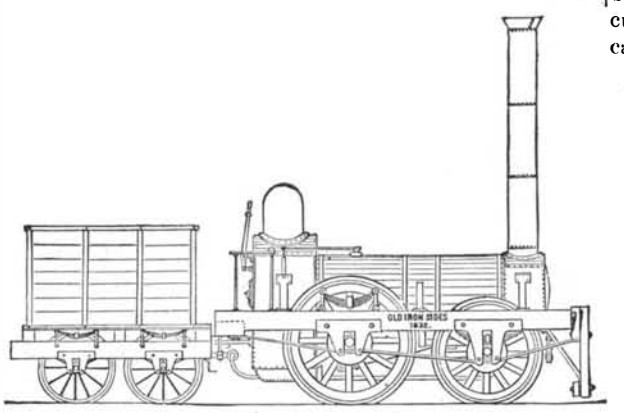
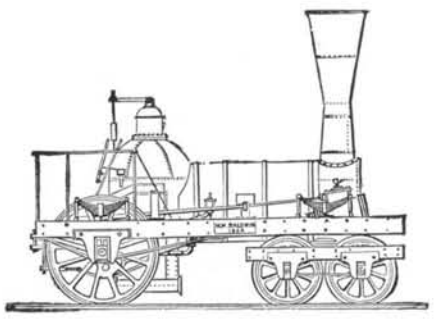
AMERICAN INDUSTRIES.—No. 90.

THE MANUFACTURE OF LOCOMOTIVES.

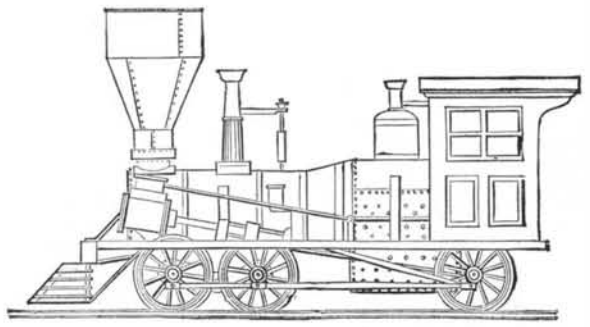
It has been a common remark, in connection with any disturbance of the money market since the war, that the country was building railways too fast. Ten million dollars a day was the estimated cash outlay on this account, according to Poor's Manual, for the three years up to the close of 1882, with a capitalization of nearly double this amount. Yet it was a felicitous comparison which suggested that even this great investment hardly exceeded that which either of three of the great powers in Europe annually expended in the maintenance of armies and iron clads in times of peace. The nation, as a whole, may therefore be truly said to have been putting only a moderate portion of its surplus into this most effective way of hastening the further development of its own resources, and though this may have afforded the opportunity, it has been in no way the cause, of any Wall Street panic.



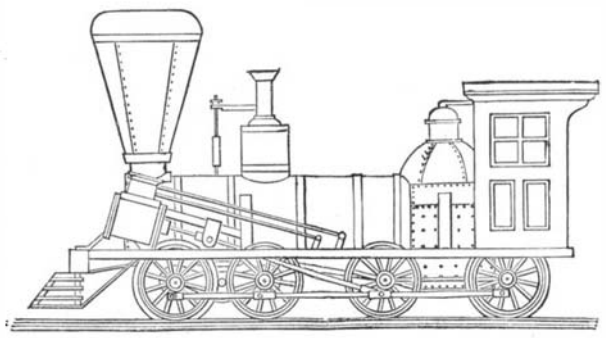
"OLD IRONSIDES," FIRST BALDWIN LOCOMOTIVE—1832.



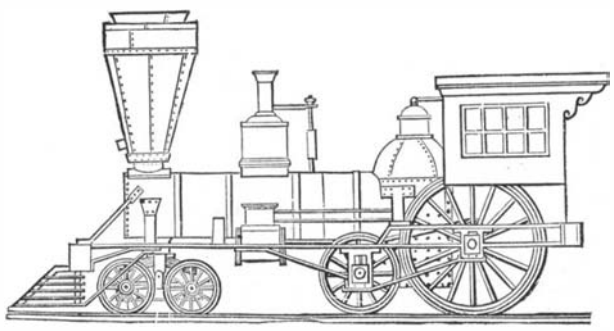
ENGINE OF 1834.



SIX-WHEELS-CONNECTED ENGINE—1842.



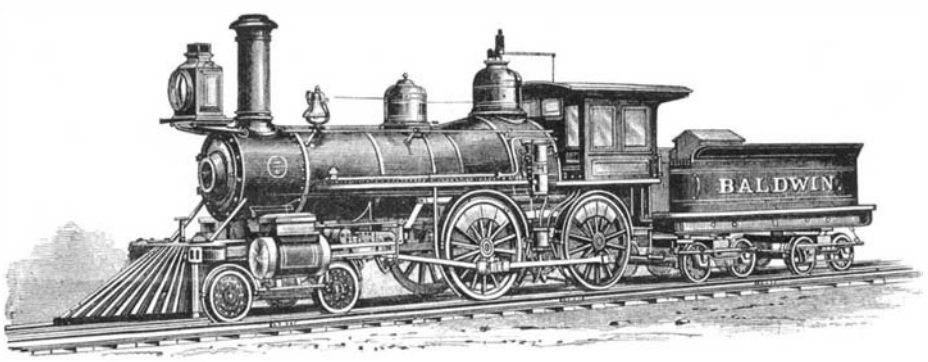
EIGHT-WHEELS-CONNECTED ENGINE—1846.



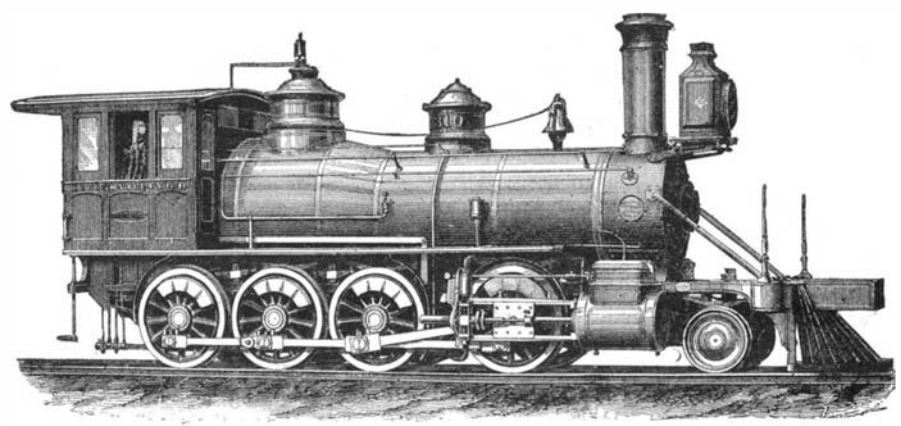
FAST PASSENGER ENGINE—1848.

Side by side with this enterprise in railroad building, at once caused by and promoting it, has been the wonderful growth of every industry pertaining to the equipment and operation of railroads. There were a few locomotives imported in the infancy of railroad building here, which met with only indifferent success, but our own inventors and mechanics early began to take the lead in this branch of manufacture and in car building, which they have ever since held. The locomotive of to-day is one of the most wonderful of all the products of man's skill, and has reached a point of perfection from which it seems hardly possible to attain further progress, so long as we obtain power from coal and wood according to principles now understood.

It is in itself an epitome of modern mechanical skill, representing almost numberless inventions, and the illustrations we to-day give, of the largest locomotive manufactory in the world, speak also of a history of its development during half a century.



STANDARD PASSENGER ENGINE.



STANDARD FREIGHT ENGINE.

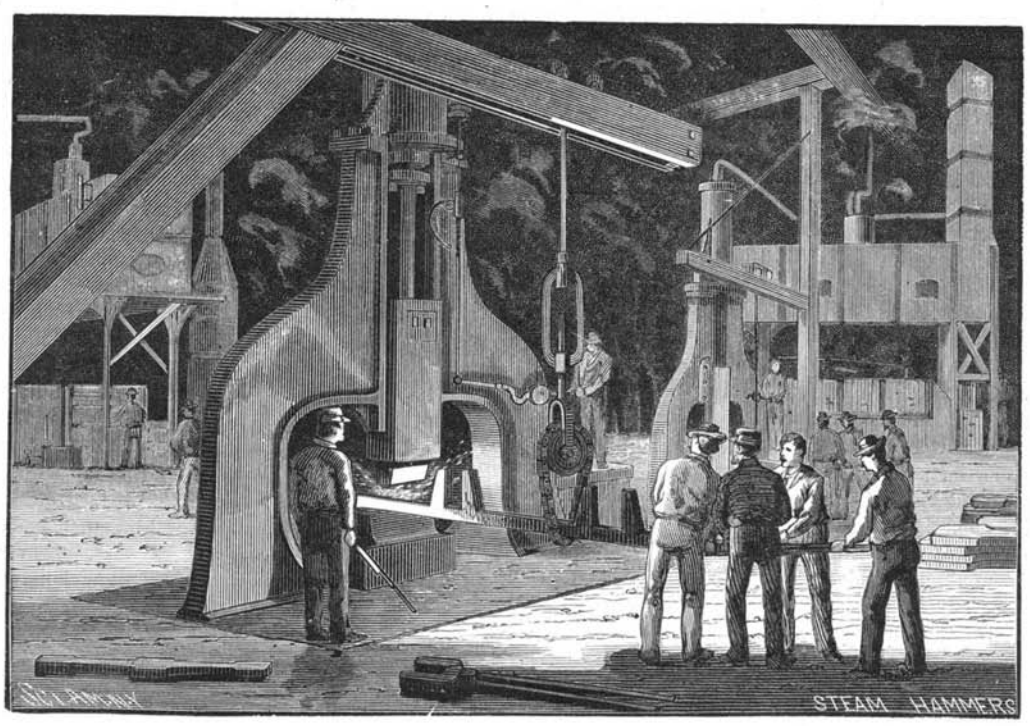
The Baldwin Locomotive Works, at Philadelphia, had an humble beginning. Matthias W. Baldwin, the founder, was a jeweler and silversmith, who, in 1825, formed a partnership with a machinist, and engaged in the manufacture of bookbinders' tools and cylinders for calico printing. Mr. Baldwin then designed and constructed for his own use a small stationary engine, the workmanship of which was so excellent and its efficiency so great that he was solicited to build others like it for various parties, and thus led to turn his attention to steam engineering. In 1831 he built a miniature locomotive, for exhibition, which was so much of a success that he that year received an order from a railway company for a locomotive to run on a short line to the suburbs of Philadelphia. The difficulties attending the execution of this first order were such as our mechanics now cannot easily comprehend. Tools were not easily obtainable; the cylinders were bored by a chisel fixed in a block of wood and turned by hand; the workmen had to be taught how to do nearly all the work; and Mr. Baldwin himself did a great deal of it with his own hands. It was under such circumstances that his first locomotive, christened Old Ironsides, was completed and tried on the road, November 23, 1832. It was at once put in active service, and did duty for over a score of years. It was a four-wheeled engine, weighing a little over five tons; the driving wheels were 54 inches in diameter, and the cylinders 9½ inches in diameter by 18 inches stroke. The wheels were of heavy cast iron hubs, with wooden spokes and rims, and wrought iron tires, and the frame was of wood placed outside the wheels.

The boiler was 30 inches in diameter, and had seventy-two copper flues 1½ inches in diameter and 7 feet long. The price of the engine was to have been $4,000, but only $3,500 was actually paid for it by the railroad company. The Ironsides attained a speed of thirty miles an hour, with the usual train, and was said at the time to be superior to English locomotives then made, on account of its "light weight, small bulk, and the simplicity of her working machinery."

In February, 1834, Mr. Baldwin completed his second locomotive, for a railroad in South Carolina. In it was embodied a "half crank" improvement which he had obtained a patent for, by which the boiler could be made larger and placed lower. The driving wheels were made of solid bell metal, the combined wood and iron wheels previously used having proved objectionable, and Mr. Baldwin obtained a patent for a cast brass wheel, his idea being that by varying the hardness of the metal the adhesion of the drivers on the rail could be increased or diminished. The brass wheels soon wore out, and no others of the kind were made, but the general features of this second locomotive were followed in most of the machines built by Mr. Baldwin for several years. The valve motion was given by a single fixed eccentric for each cylinder.

Five locomotives were built in 1834, when the new business was fairly under way, and in 1835 a building was erected for the works, which occupies a part of the present site on Broad Street, this original structure now forming the storeroom, boiler shop, and principal machine shops. All these engines built in 1834 had several patented inventions of Mr. Baldwin. They had the half crank, ground joints for steam pipes, and the pump formed in the guide bar, four-wheeled truck in front, and a single pair of drivers back of the fire box. The English engine builders were then making steam pipe joints with canvas and red lead, which would only permit of their carrying a pressure of some sixty pounds of steam, while Mr. Baldwin's locomotives were worked up to twice that pressure.

In the six years from 1835 to 1840, inclusive, 152 engines were turned out at the works, and, though there were not many changes in design, there was a call for larger engines. Three sizes were built: 12½ by 16 inches cylinder, weighing 26,000 pounds; 12 by 16 inches cylinder, weighing 23,000 pounds; and 10½ by 16 inches cylinder, weighing 20,000 pounds.



VIEW OF PRINCIPAL STEAM HAMMER—SINGLE ACTING.

In 1842, Mr. Baldwin patented what has since been considered the greatest of his improvements in engine building, the six-wheel connected locomotive, with the four front drivers combined in a flexible truck. The first engine of this class weighed twelve tons, and its performance was so successful that orders for similar ones came in rapidly. The adoption of this plan of building also led to the immediate increase of the weight of locomotives, and in 1844 several

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were built weighing eighteen and twenty tons. In 1845 the present design of four drivers and a four-wheeled truck was adopted. At first the half crank was used; then horizontal cylinders inclosed in the chimney seat and working a full-crank axle, and eventually outside cylinders with outside connections. In 1848, Mr. Baldwin took a contract to build for the Vermont Central Railroad, for $10,000, a locomotive which would run with a passenger train at a speed of sixty miles an hour. It had one pair of driving wheels six and a half feet in diameter back of the fire box, and the cylinders were seventeen and a quarter inches in diameter and twenty inches stroke. This engine was used on the road several years, and the officers stated that it could be started from a state of rest and run a mile in forty-three seconds.

A prominent feature in the conduct of the business of the Baldwin locomotive works is the extensive use of standard gauges and templets. An independent department of the works, having a separate foreman and a force of skilled workmen, with special tools, is organized as the department of standard gauges, where gauges and templets for every description of work are made and kept. The original templets are kept as standards, and never used in the work itself, but from them exact duplicates are made, which are issued to the foremen of the different departments. The working gauges are compared with the standards at regular intervals, in order to secure absolute uniformity in every detail. Frames are planed and slotted to gauges, and drilled to steel-bushed templets; cylinders are bored and planed, and steam ports, with valves and steam chests, finished and fitted to gauges. Tires are bored, centers turned, axles finished, and cross-heads, guides, guide-bearers, pistons, connecting and parallel rods, planed, slotted, or finished by the same method. Every bolt about an engine is made to a gauge, and every hole drilled and reamed to a templet, so as to secure uniformity and interchangeableness of parts. This system had been developed and perfected previous to the death of Mr. Baldwin, which occurred in 1866.

The heaviest locomotive built at the works up to 1878, and one of the heaviest ever built, was for the New Mexico and Southern Pacific. It was of the "Consolidation" type; cylinders, 20 by 26 inches; driving wheels, 42 inches diameter, four pairs connected; one pair truck wheels, 30 inches diameter; capacity of water tank on boiler, 1,200 gallons, and of tender 2,500 gallons; weight of engine, including water in tank, 115,000 pounds, and weight on driving wheels 100,000 pounds.

The works, when running full, give employment to 3,000 hands, and are capable of turning out 600 locomotives a year. Their actual production for the last forty-two years has been as follows:

1842	14	1863	96
1843	12	1864	130
1844	22	1865	115
1845	27	1866	118
1846	42	1867	127
1847	39	1868	124
1848	20	1869	235
1849	30	1870	280
1850	37	1871	331
1851	50	1872	422
1852	49	1873	437
1853	60	1874	205
1854	62	1875	130
1855	47	1876	232
1856	59	1877	185
1857	66	1878	292
1858	33	1879	398
1859	70	1880	517
1860	83	1881	555
1861	40	1882	563
1862	75	1883	557

There are about 15,000 locomotives of all kinds in actual use in the United States, the Pennsylvania Railroad leading with over 1,100, the New York Central coming next with 700, after which come in order Chicago, Milwaukee, and St. Paul, Baltimore and Ohio, Erie, Chicago and Northwestern, Philadelphia and Reading, and Chicago, Burlington, and Quincy—each with more than 500.

The Baldwin locomotive works has furnished a large proportion of all these, but it has further made locomotives for almost every country in the world. Russia has been a liberal purchaser, many have gone to Central Europe, Australia has many of these American engines, and South American roads have been principally supplied from here.

The area covered by the works, on Broad Street, Philadelphia, is rather more than nine acres. The view of the erecting shop shows a great number of locomotives under way, but it is only a faithful representation of the scene when our artist visited the works, and gives only a fair idea of the average amount of work in hand. This immense production gives the firm great advantages in the filling of orders promptly, and the fact that all parts are made interchangeable renders it possible for the purchaser to keep the expenses for repairs at a minimum, by keeping duplicate parts of pieces likely to break or wear out, or by ordering them as needed from the works. In the boiler shop, while there is some riveting done by hand, power machines are mostly used therefor, and the view of the wheel department illustrates the forcing of the driving wheels upon their axles. The steam hammer shown is one of several of the same kind in the works. It is single acting, 7,000 pounds weight of ram, drop four and a half feet, and piston rod five inches diameter.

The firm as now constituted was formed in 1873, under the style of Burnham, Parry, Williams & Co.

Noxious Manufactures.

There is just now a most wholesome activity in regard to the national health, and the public are peculiarly interested in the various details of our sanitary machinery. Of this, by no means the least important department is that instituted under the Alkali Works Regulation Act, 1881, or, in other words, the inspection of noxious works and factories. In connection with the pollution of rivers, this is an old grievance; but too little has hitherto been done to realize or remedy the evil in its general effects upon the public health. So greatly, too, have works prejudicial to health increased of late years, that their inspection has been decided upon none too soon. Probably, it will never be known how far the death rate has been influenced by this cause. It is, however, one of the unavoidable penalties of civilization that we should live under unwholesome conditions of life.

A multitude of influences injurious to health spring into active existence with the development of commerce and the growth of luxury. Most of these are evident enough. All the elements, indeed, are equally guilty. The earth, air, fire, and water are allied against civilized humanity; and modern science is constantly bringing to light disagreeable facts in this connection. We have long lived in the comfortable belief that Mother Earth was the great purifier. The reverse is, it seems, nearer the truth. Years after the germs of infection have been consigned to the ground, they have been disinterred, and found to be not a whit diminished in virulence. Archæologists should, we are told, beware of handling newly found relics, lest, perchance, they should contract some archaic disease. Even mummies, it appears, in spite of their venerable respectability, are objects of legitimate suspicion! Fire, too, has a dreary catalogue of sins to answer for. It not only robs us of much of the oxygen of which those of us who live in the towns have so scanty a supply, but it gives us in exchange unconsumed carbon in quantities which fill the air with smut. In smoke alone it furnishes us with food for reflection—and digestion—and probably will continue to do so for some time to come.

Again, water is the most insidious enemy of all. The most indispenable of the elements—and we are reminded of our obligations to it pretty frequently—it is credited with doing the greatest harm. In league with unnatural substances, it has developed such an affinity for noxious matter that it appears that nothing short of boiling can possibly enable us to drink it with any security. To most people cold boiled water will not seem a very attractive beverage, but it has the advantage of being in many ways a safe one.

The air, too, is anything but true to the trust committed to her charge. We have long confidingly believed in her good will. Our sewers, drains, and chimneys discharge their pestilent exhalations into the air; but instead of carrying these away into space, she receives them only to bestow them upon us again.

The outlook is indeed gloomy, and unless we make some progress in sanitary science, it is not a little difficult to see how we are to continue to support the burden of civilized existence.

In this connection it is reassuring to know that something is being done to lessen these ominously numerous artificial dangers. The works which come within the scope of the Alkali, etc., Works Act, 1881, are very injurious to life. The manufacture of alkalies, acids, chemical manures, salt, and cement alike involve processes prejudicial to health. More than one thousand of these were visited by the inspectors, appointed in pursuance of the above Act, during the year 1882; and it is interesting to know that some intelligent means are being devised whereby the offensive character of these manufactures may be diminished. To take a single cause of mischief. The manufacture of alkalies and acids has long been conducted in such a way that the proportion of noxious matter which was allowed to escape into the chimney or atmosphere often reached from twenty to forty grains per cubic foot of air, twenty being a not uncommon amount. The maximum amount which might be allowed to escape with impunity has been estimated at four grains per cubic foot; and it is a very important feature of the Act that it has been instrumental in reducing this very considerably. In the alkali works proper the escape has been brought down to two grains, while in some cases it is under one. The sulphuric acid works alone are now conspicuous for their failings in this important respect, the average escape in those examined during the year being 5·5. Again, chemical manure works have long been a pregnant source of annoyance to the inhabitants of the neighborhood in which these are carried on.

It is, curiously enough, the smaller establishments of the kind which are the most harmful. The larger works have long employed the most complete processes, because the escape of effluvia would otherwise have been so great that it would have speedily aroused hostile action on the part of the public. The imposition of preventive measures in the case of the smaller works—in many of which no precautions whatever have hitherto been adopted—is attended with some difficulty, since it involves an expenditure which would in some cases be almost prohibitive. It appears, indeed, that no maximum of escape can be fixed in works of this kind, and all that remains to be done is to render it compulsory that processes should be adopted for washing out such gases as are soluble, and for burning those which are more susceptible to such a method of treatment. Since such pernicious agents as fluorine compounds escape during the action of sulphuric acid upon phosphates, the question is one of some urgency. Again, another cause of complaint is the escape of sulphureted hydrogen during the process of making sulphate of ammonia. In the larger gas liquor works the gas is burned, and converted into sulphuric acid in lead chambers; while in others it is passed through oxide of iron; and both these methods are perfectly satisfactory when properly carried out. Again, the discharge of sulphurous or muriatic gases evolved in extracting salt from brine is an evil which has remained unremedied almost down to the present time. Not the least curious feature of this question, too, is the fact that many of the products of distillation are so valuable that it is more than mere neglect to throw them away in the form of noxious gases. It is unnecessary to describe here the state of the salt districts. They might serve as a type of the abomination of desolation. The combined effect of the gases and the soot, which pour forth in prodigious volumes and from the chimneys of nearly a hundred salt works in Cheshire alone, is most deplorable.

The only possible conclusion from this report is that we are still far behindhand in these matters. We have, for instance, long continued to burn coal on the same principle, and are very slow to believe in any of the new methods which have been and are continually being introduced. Yet not only is black smoke very much more injurious to animal and vegetable life than when it has been rendered colorless by burning, but it is peculiarly wasteful. It has long been known that many valuable commodities could be obtained from coal; and but too little progress has hitherto been made in this direction. It is, then, all the more interesting to know that in some works in the north of England the gases from the blast furnaces have been cooled and washed, and ammoniacal salts obtained in such quantities as to make the process economical; while by the "Young and Beilby" process it is contended that not only can the fuel be consumed for nothing, but that there will be several shillings a ton profit.

So far as manufactures are concerned, there certainly seems to be no valid reason why the rule that they must consume their own smoke should not be much more freely enforced. In the case of the alkali trades, which have long been in a very bad state, it is, of course, an unfortunate time to suggest the necessity for the outlay of more capital in improved works. But the exigencies of the public health are paramount, and needlessly offensive processes cannot be tolerated much longer. Such a case as that reported from Widnes, where waste heaps of offensive matter, consisting chiefly of sulphur and lime, are allowed to accumulate, although the sulphur could be extracted at a profit, and so prevented from poisoning the streams for miles around, is certainly difficult to explain. The drainage from these heaps alone is estimated as carrying away twelve tons or seventy pounds' worth of sulphur a day. But perhaps as soon as some satisfactory system for eliminating the sulphur has been hit upon, this will be remedied. We have certainly much yet to learn in sanitary science. The old theories are one by one being exploded, and it will no longer do for us to poison the air we breathe, under the pleasing impression that its purifying properties are inexhaustible. Civilization has made such strides that she has succeeded in overturning the equilibrium of nature. The equilibrium must be restored.—*Chambers's Journal.*

Buildings that Resist Earthquakes.

The volcanic eruptions in Java, the earthquakes in Ischia, and our own western tornadoes, have probably caused much more destruction of life and property than they would have caused if buildings had been specially adapted to resist them. In Japan, where shocks of earthquake are frequent, a contemporary says that it is not usual to dig foundations for any building, no matter how large or important it may be. Rocks slightly rounded at the top are placed where the corners of the house are to be. The corner posts, rounded at the end, rest on these. The timbers are all pinned together, not nailed, so as to allow of considerable movement without coming apart. In the central portion of the building the timbers are particularly heavy, and act as ballast. In high towers there are sometimes huge beams swung from the roof and reaching to within a foot of the ground, which prevent the building from being overturned either by earthquake or storm. The oldest building in Japan, the Treasury at Nara, is built in this manner, without the swinging beam, but with a very heavy ballast in the framework of the center of the floor. A well known artist is the inventor of a painting hut which is constructed in part on the same principle. It rests on stones at the corners, the timbers are keyed together, and it carries a heavy ballast under the floor. It is, however, in addition, secured to the ground by ropes and anchors. This hut will outride a gale in perfect safety.

"Deep Water Fishes."

The article in our paper of May 10 contains an error, from misprint, which should be corrected, as it conveys a false idea. "One of the results has been to reveal the fact that a remarkable group of fishes—*Malacosteus*—have their home only in those hidden depths." This is perfectly correct if the word *Malacosteus* is omitted, as it was in the original copy. There is no such *group* as *Malacosteus*. It is a single genus, with a single species, *M. Niger*, and the only specimen which has yet come to light is the one originally described by Dr. Ayres in 1851. The sentence might well read: "A group of fishes, of which *Malacosteus* was long the only one known, have," etc.

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Dynamite Blasting under Water.

Some few years ago, when it became necessary, owing to the expansion of fuel shipments at Lydney-on-Severn, the chief shipping place for the Dean Forest coal field, to extend the depth of water, to accommodate vessels at the above docks, the resort to dynamite as an explosive proved sufficiently successful, that not only was the undertaking completed, but this was accomplished when other processes had practically failed. As indicated, the object involved the enlargement of the lower floating basin, the depth of water required being 15 feet. In the breaking up of the lower rock, under water, Mr. Keeling eventually determined to try dynamite, and under the recommendation of Mr. William Blanch Brain, of Trafalgar Collieries, the charges were exploded by electricity.

It has been recently determined to perform similar operations in the river basin, and it is in respect to these that some information as to the *modus operandi* may prove of service where blasting operations necessarily carried on under water are a *sine qua non*. Mr. Keeling has again resolved to employ Mr. Blanch Brain's method of simultaneous electric blasting, viz., the electric apparatus, Brain's electric fuses, cables, exploder, etc. The custom is, where operations of the character named are about to be introduced, a responsible person is sent to instruct, and take charge, until the local parties themselves are competent to undertake the operations. As the sides of the basin are slanting, it is intended to remove the rock in order that the lower bed of the dock shall be level across its entire width. The workmen are provided with a raft, about 20 feet by 40 feet, two gangs of men employing "jumpers," three men to each. A series of holes are made—say from four to eight. The fuses have about 9 inch wires attached to them, and to these are connected the joint, insulated with Chatterton compound and tape, with tough cables, to reach the raft from bottom of hole. The fuse is then inserted into a primer in the middle of a calico or canvas bag, containing half a charge in two-ounce cartridges.

Having been thus prepared the charge is dropped down a pipe, the ends of the wires being on the raft. When all the holes are so charged, the wires are connected in series, and to the two end wires are connected the cables from exploder, which is on the shore. This machine is turned from fifteen to twenty times, according to the number of shots to be fired, and by reversing the handle, say 3 inches, the electric charge is freed, and all the shots are simultaneously exploded. Brain's improved American frictional electric exploder is being successfully used, which machine is capable of giving a spark 3 inches in length. After the shots the wires are disconnected and drawn up. Where they are at all damaged by the rock they are cut off above the places, which may be about 6 inches for every shot, and can be used again. Mr. Carl T. B. Brain represented his father at the preliminary explosions, and the work is progressing. In the comparison of expense Mr. Keeling estimates that the present process costs 4s. per cubic yard, against 5s. 6d. with the powder system. It may be added that Mr. Brain's system is being extensively employed in colliery operations in both home and foreign coalfields. At Hawkwell Colliery, Dean Forest, the late Mr. Chivers experienced great difficulty in extending his shafts the last 30 yards, owing to the bottoms being always covered with 2 to 3 feet of water. The charges in that case were simultaneously blasted by the electric machine with the highest degree of success. To mining operations of all degrees where blasting is required the process of Mr. Brain is of great interest and utility, both in respect to its economy, safety, and expedition.—*Colliery Guardian.*

Fluids and Fat.

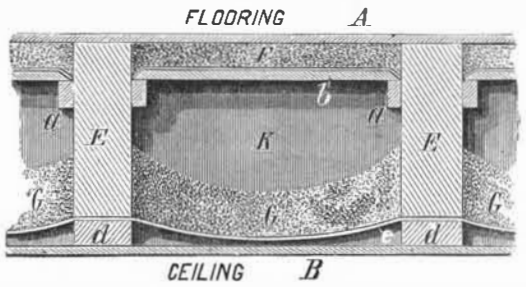
The removal of surplus fat from the body by appropriate means naturally forms a subject of interest to the well-to-do classes Various modifications of solid diet having had their day, the consumption of fluids is now undergoing regulation in respect of quantity among those who find their own presence insupportable. There is something in this theory, inasmuch as liquids, merely as such, materially aid the digestion and absorption of the food with which they are taken. Again, several of the fluids in most common use are, directly or indirectly, fat forming. Thus cocoa contains a very large proportion of fat, coffee a considerable amount along with amyloid substances, which are also represented in tea to a much smaller extent, and which readily pass by chemical decomposition into the form of fat. Beer, wine, and spirit are all fattening, partly in consequence of their saccharine and starchy constituents, and partly from their tendency to hinder excretion of waste products of food, and, when acting on any but a languid frame, to hurry and to slur that methodical oxidation by the blood on which the maintenance of sound tissue depends. General opinion, we are sure, will bear us out in saying that when the solids consumed are moderate in amount and digestible, and when the fluid is merely fluid, not fatty or amyloid in its composition, and not stimulant, free drinking will not influence obesity. We can call to mind heavy drinkers of water and regular consumers of tea, moderate in diet otherwise, whose habits engendered not the slightest tendency to corpulence. We should without hesitation recommend their practice to the stout, and should rely for the reduction of their bulk not on any further alteration of their diet, which might easily be carried so far as to starve their more important tissues, but on the maintenance of regular and sufficient physical exercise.—*Lancet.*

DOLMAN'S FIRE DAMPERS.

The efficacy of ashes as a fireproof material and fire damper was forcibly demonstrated recently in this city, where an exhibition of Mr. W. H. Dolman's system of fireproofing took place. The object aimed at by the inventor is to make buildings with wooden floor beams as safe against fire as iron beams and tiling.

The accompanying illustration is a sectional view of the flooring timbers, B, the plastered ceiling, and A, the floor. After the joists or beams, E E, are in position, a sheet iron ceiling, *e*, is nailed on. One sheet may overlap another one-half to three-quarters of an inch, or each edge may be hooked half an inch. Upon this sheet iron ceiling about three inches of dry, finely-sifted ashes, G G, are placed, the ashes being settled down carefully and banked up against the sides of the joists.

Provision is also made for deafening the floor by constructing another layer, F, above the first, as shown, upon which the flooring is finally laid. Furring strips, D D, are nailed to the bottom of the joists to overcome the sagging of the sheet iron, and then lathed and plastered as usual.



DOLMAN'S FIRE DAMPER.

It will be seen that this method combines simplicity with cheapness. In the test made in this city, which we witnessed, the wooden beams of a structure so protected showed not the slightest indication of attack, after being subjected for more than half an hour to an intense heat; similar trials in Chicago and other cities have had the same successful results.

In small towns, where imperfect or volunteer fire departments exist, the danger from fires would be greatly reduced by this method. The excellence of this system is indorsed by underwriters. By its use any wooden timbered building, at a very small cost, may be greatly protected against fire.

Patented by Mr. Wm. H. Dolman, of No. 229 Broadway, room 15, New York city.

IMPROVED SEWER PIPE TRAP.

This is the invention of Mr. Herman Pietsch, of Flatbush, L. I. The construction and operation are the same as the ordinary trap, except that in the pipe above the water seal there is a light valve, J, as shown in the cut, Fig. 1.

The sewage pipe, C, dips within cup, F; and the overflow rises over the upper edges of same and escapes into box, A, and off through B. The extremity of C is always kept sealed by the liquid within cup, C. In the ordinary trap, when there is a downward suction in B, it is apt to draw out the water seal in F, and when this seal is gone

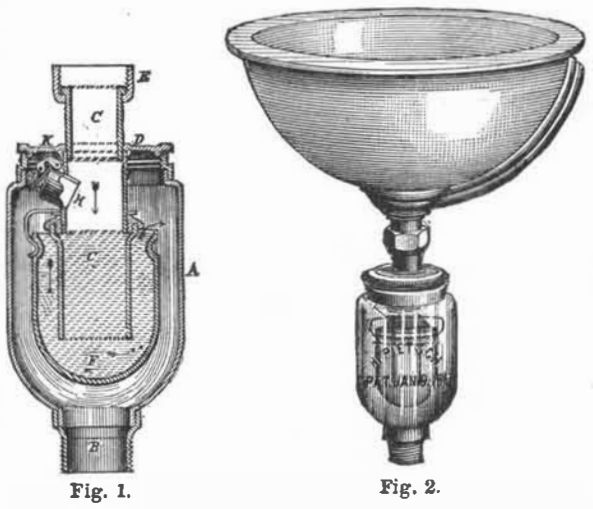


Fig. 1. Fig. 2.

PIETSCH'S IMPROVED SEWER PIPE TRAP.

there is nothing to stop the back flow or rise of the sewer gas into the room or house. But in the present improvement, when any down suction takes place in B, it causes the valve, J, above the seal to open, thus drawing off the gas *without disturbing the water seal in* F, and any rise or back pressure of gas closes valve, J, and is resisted by the water seal in cup, F.

We believe this is almost the only trap which carries with it an effectual means for preventing the siphonage of the water seal. In many cases, especially where the old styles of traps are used, and it is inconvenient to attach ventilating pipes to them, the substitution of this improved trap will instantly remove all troubles from back flow of gas. This trap has, after thorough trial, proved to be superior, and is highly spoken of by several prominent sanitary authorities. The American Institute declared it to be entitled to a higher award than any article of the kind on exhibition, and among its qualities the judges said it could not be siphoned, and it was impossible for back pressure of sewer gas to go through the seal.

Architects and others who wish to provide their structures with an economical but really good safeguard against sewer gas dangers, will do well to examine this improvement.

Wax Matches.

At the Nice Exhibition were two machines employed in the manufacture of wax matches and match boxes, shown by M. Perrier, of Marseilles. The first of these is used to cut the matches to the proper length. The wick covered with the wax coating is wound in long lengths upon the reels, one placed above another and revolving freely. These reels are divided around their circumference and for their whole length into separate compartments, in each of which the match material is wound. Altogether, in the machine shown, there are 100 independent lengths, 50 on each reel, and each length is brought to the front of the machine through a row of horizontal guides placed at equal distances apart. Here they are held, and a slight reciprocating and intermittent motion is given to them in order to feed them forward at each stroke. In front of the machine provision is made for holding a stout wooden frame, having, however, only three sides, the two vertical sides being slotted to receive the ends of a number of narrow wooden strips, covered on each side by cloth. These strips are, before the machine is started, held up clear of the wooden frame before mentioned, and at each stroke of the machine one strip is allowed to fall into the frame; at the same time the latter is moved down slightly. The machine being started, the ends of all the wax-covered wicks are fed forward sufficiently to bring them on to the bottom bar of the frame. As soon as this is done, the lowermost of the strips falls into the frame and lies on top of the ends that have been fed forward, at the same time holding them. A knife is then traversed across the machine, cutting all the wicks to the desired length. After this the frame falls sufficiently to allow the ends of the wicks to be again fed forward, another strip falls, and the operation is repeated. In this way the action is continued until the frame is full, with from 10,000 to 30,000 pieces, according to the size of the machine. The fourth side of the frame is then introduced, and the whole assemblage is securely locked. To convert these blanks into matches all that remains to be done is to dip their ends at one operation into the igniting composition.

The second machine, exhibited by the same maker, is for completing the well-known sliding boxes in which the matches are sold. It is somewhat on the type of an envelope-making machine. The blanks of the boxes or cases, whichever may be in course of manufacture, cut to form and decorated, are placed in a trough, one end of which is fitted with a spring that presses the row of blanks against a gumming device that forms the other end of the box. The operation of drawing the blanks successively from the trough deposits the gum on the exact places required. The attendant then inserts the blanks one after another into a former, which doubles them to the required shape, and delivers them as finished cases or boxes, as may be. But if after being thus finished they were discharged from the machine, the gum would be still wet and would not hold. This difficulty is got over by the use of a large and broad wheel placed in front of the machine. Around the periphery of this wheel, and parallel with its axis, are formed a large number of grooves the width and depth of the boxes. The width of the wheel is equal to the length of four or five boxes, and light strips of brass are placed around the circumference at intervals. As soon as the completed box is delivered from the former, instead of falling to the ground it is forced into one of the grooves in the wheel, the motion being so regulated as to bring a groove opposite the mouth of the former each time a box is delivered. But the action of forcing one box into one side of the groove displaces another on the opposite side. The wheel is then moved forward; another box is completed by the time the next groove is presented, and so on. By this arrangement each box remains in its groove until the wheel, which travels slowly, has made several revolutions, and thus sufficient time for the gum to dry elapses before the turn of any box comes to be ejected.

Egyptian Remains.

At Ekhmeem, a large provincial town of Upper Egypt, situate about halfway between Assiout and Thebes, Prof. Maspero, returning from his annual trip of inspection up the Nile, has just found, according to *Nature*, a hitherto undiscovered and unplundered necropolis of immense extent. As far as has been yet ascertained, the necropolis dates from the Ptolemaic period; but, as the work of exploration proceeds, it will probably be found that it contains more ancient quarters. The riches of this new burial field would meanwhile seem to be almost inexhaustible. Five great tombs or catacombs, already opened, have yielded a hundred and twenty mummies, and, within the short space of three hours, Prof. Maspero verified the sites of over a hundred more similar catacombs, all absolutely intact. The necropolis of Ekhmeem, at a rough estimate, cannot contain fewer than five or six thousand embalmed dead. Of these, perhaps not more than twenty per cent will turn out to be of archæological or historical value; but the harvest of papyri, jewels, and other funeral treasures cannot fail to be of unprecedented extent. Ekhmeem is the ancient Khemnis—the Panopolis of the Greeks. Its architectural remains are insignificant.

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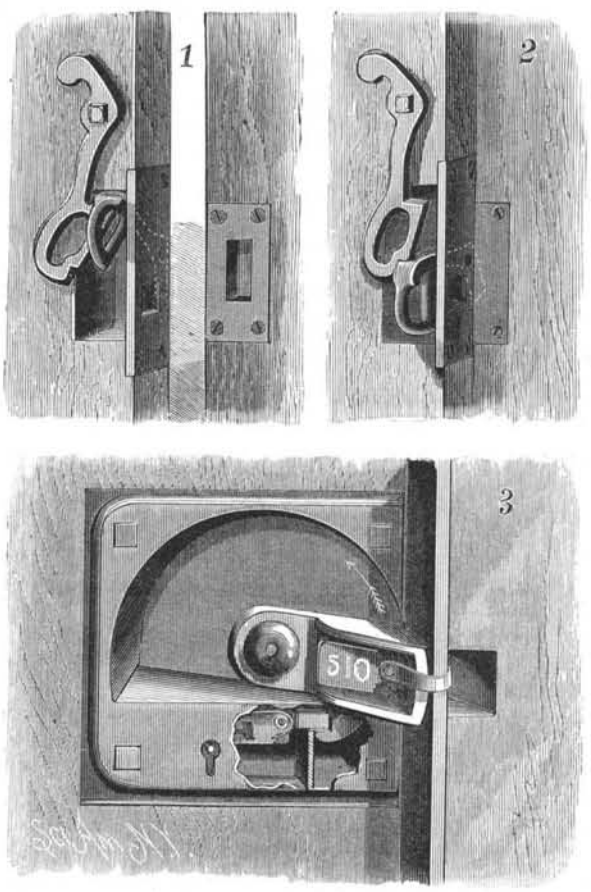
FREIGHT CAR DOOR LOCKS.

The accompanying engravings represent two simple, strong, and durable locks for fastening doors of freight cars. The upper figures show a device for securing the end doors so that they cannot be opened from the outside—Fig. 1 showing the lock open and Fig. 2 showing it closed. To lock the door it is simply necessary to push the toggle to one side, when the weighted end swings the bolt down so that its other end enters the recess in the door; at the same time the toggle swings forward, and its lower end rests upon the bolt, which is held firmly in place. To unlock the door the toggle is pushed one side, and the bolt raised until it is supported upon the upper catch of the toggle. The dotted lines show the small end of the bolt in the two positions. The seal holding tag can be passed through an opening in the side plate and through the end of the bolt. The lock is reversible, and will fit on either door post.

In the lock shown in Fig. 3 the bed plate is made with an inclined bottom, in the center of which is pivoted a button which, when in the position shown in the cut, most effectually prevents the door from sliding. When the button is moved to the inside of the inclined bottom, the door is free to move by. From one side of the button projects a hook, in which a strong three tumbler lock bolts and secures the button in its outward position. The tumblers and lock bolt are made of brass, the latter being so placed that rough usage will not affect it; the locks are of malleable iron. Cinders, snow, etc., are prevented from entering the lock by an inside escutcheon for the keyhole. Openings are made in the button and side plate large enough for the seal and for the U. S. lock for bonded goods.

These locks are manufactured by Mr. J. Hyde Fisher, of 50 State Street, Chicago, Ill.



FISHER'S FREIGHT CAR DOOR LOCK.

PETROLEUM INDUSTRY OF BAKU.

It is singular that although the oil wells of Baku have been known for over fifty years, it is only within two or three years that they have been worked to any extent, and only within a few months that the public generally have had the fact of their existence thrust upon their attention. This condition of affairs is due to several reasons, the principal of which is that Baku is located upon a remote frontier of the Russian Empire, being separated from commercial Russia by the exalted range of the Caucasus, and having no railroad communication with the interior. Its former obscurity is due, however, more to the lack of enterprise on the part of those who undertook to work the wells than to its geographical situation; for although its location is remote as regards the market, it is situated on the shore of a great inland sea, the Caspian, and in this respect has a great advantage over our own oil producing district. The cause of Baku having been brought so unexpectedly and suddenly before the public notice is due perhaps to the fact that the wells have been brought under the control of a new management, who have spared no means or expense to bring the wells into the most perfect working condition, and who have had the keenness to perceive that it was not the expense in procuring and storing the oil which rendered the petroleum high priced by the time it reached the market, but the awkward facilities of transportation at that time afforded; and it has been to this that the energies of the new company have been principally directed, and in this their efforts have been rewarded with success, for Baku has been connected with the Black Sea by a partially unfinished railroad since 1881, which road was monopolized during that period by a single company. The road has recently been thrown open to the public, however, and the petroleum is now introduced into the European market at very much reduced rates, and has become a very formidable rival to its American cousin.

This, by the way, is about as close a relation as it holds to our Pennsylvania petroleum, for the latter for illuminating purposes is a far superior product, while as a lubricator it is said not to equal the Russian oils. According to Professor Mendelyeff's analysis, the Baku petroleum contains 20 to 40 per cent. of lubricating matter, while the American contains but 7 per cent. of this substance.

The wells are by no means as deep as our wells on this side the water, and some of their best producing drives are not more than 500 feet deep, while the deepest well of Nobel Bros., who are the largest owners in this region, is but 735 feet in depth, and the yield from this drive is perfectly enormous.

It will be seen from this, says *Engineering*, to which we are indebted for our cut and the following details, that the Baku people have not exploited to any very serious extent their petroleum deposits. Years must elapse before 1,000 feet, a common depth in America, will be attained; and at least two or three decades before they touch the cells 2,000 feet below the surface, as has been already done in many cases in Virginia. The present supply of oil is so enormous at the feeble depth of from 100 feet to 600 feet below the surface, that no inducement to deep sinking exists. Wells are only being bored in the hope that the impending opening up of the European market will cause a rapid and unprecedented demand for crude oil; or, as in the case of Nobel Brothers, who have a dozen good spouting wells plugged up, simply to keep the staff employed. The gravity of the crude oil ranges from 0·780 to 0·890, and no deterioration has been observed in quality in that obtained from the lower depths.

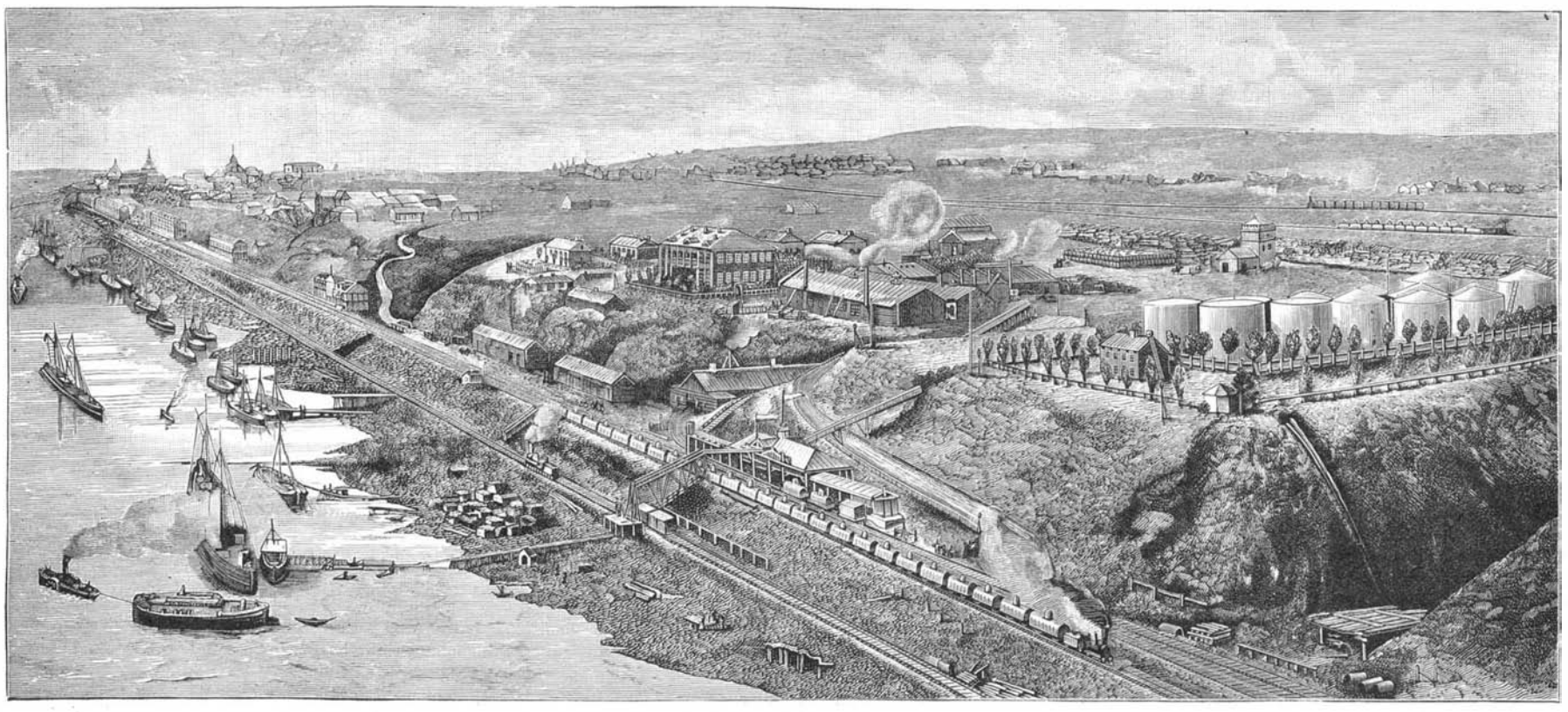
The mode of boring for oil is the American, modified to suit the characteristics of the Apsheron peninsula. To Messrs. Nobel Brothers belongs the credit of having introduced the composite system now in vogue, they having brought over to Baku six borers from Pennsylvania early after commencing operations in 1875.

Nobel Brothers, whose organization in almost every detail is as perfect as care can make it, lodge their employes in spacious and commodious stone barracks alongside their borings. A telephone connects their wells with the office at Baku, and again with the manager's residence in the Swedish colony that is growing up outside Baku. From Baku telegraphic communication is maintained with all parts of the world.

Boring for petroleum in the Apsheron peninsula is conducted much in the same manner as that for coal. An iron bit, gouge shaped, is fitted to a boring bar 8 feet or 10 feet in length, which is successively fitted to other lengths as the depth of the piercing increases. The strata consist of alternate sand and rock. It is in the sand that often the greatest difficulties are encountered. A loose bowlder will meet the boring tool, and, displacing itself, leave the passage free. But when the rods are withdrawn to allow the introduction of the tubes which form the lining of the well, the bowlder falls back in its place, and baffles all attempts to continue the work. This bowlder difficulty is the great terror of those commencing to bore. The diameter of the bore is invariably from 10 inches to 14 inches. The thickness of the tubes runs from one-eighth inch to three-sixteenths inch.

When the oil is touched there is usually a lengthened discharge of light carbureted hydrogen. Sometimes this pours up the pipe with terrific force, roaring so loudly that nothing can be heard alongside the well. As often as not grit is carried up with it, and finally comes the oil. Directly the gas begins to blow, all haste is made to withdraw the boring rod and fasten a *kalpak*, or iron cap, over the orifice. This is fitted with a sliding valve to regulate the passage of the gas and oil, Should the well be successfully capped over, the chief danger of an irrepressible fountain is removed, but it often happens that the oil follows too fast, and then nothing can be done to check the outburst of petroleum until its force moderates. Last year, when the engineers at Nobel Brothers' No. 25 well struck oil, the gas exploded and blew into the air 500 feet of boring rod before it could be removed. Formerly the tubes were sunk without any packing round the top. The consequence was that when they were capped the pipes burst. To obviate this it has been the custom for some years past to dig down 20 feet or 30 feet round about the mouth of the well, and fill it up with a concrete or asphalt setting. If this be well done, it will resist the strongest pressure, in spite of a filtration through it, as occurred when the Droojba fountain was stopped last December. With but a few exceptions, every care is taken by the well borers to prevent the wells becoming fountains beyond control. The Droojba catastrophe was due to an accident. The well was properly capped over, and it was while improving and strengthening the cap that the oil suddenly blew it off and spouted 300 feet high. It then became, of course, beyond control. In a few days the grit carried up with the oil ground to pieces the huge and massive beams at the top of the derrick.

Some weeks ago a report circulated in the English press that one of the oil fountains at Baku had spouted with such force as to fracture a 3 inch cast iron plate placed over the orifice to divert the stream. This was on the face of it erroneous, the real circumstances being these: When the oil is projected, it carries with it the grit with such force as to convert its volume into a sort of liquid grindstone. If an iron plate be placed in contact with the stream, the sand in the oil literally grinds it to pieces in a few hours. The first



NOBEL BROTHERS' PETROLEUM DEPOT AT TSARITZIN, RUSSIA.

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caps that were used at the Balakhani wells were completely destroyed in this manner. Messrs. Nobel Brothers have one at their office at Baku preserved as a curiosity, which was worn into holes in a few hours, although 3 inches thick. It was this circumstance that led to the invention of a special kind of cap fitted with sliding valves. As might be imagined, when a fountain spouts as high as the Monument it forms round about the mouth of the well immense shoals of sand, which extend sometimes to the distance of a hundred yards from it. Houses are not infrequently completely buried in these mounds, and the mouths of neighboring wells covered for a time, involving heavy claims for compensation.

As soon as the oil ceases to spout, pumping is resorted to. The cylinders used are 10 feet long by 10 inches broad, and have at the bottom a valve which opens on touching the ground, and closes when the tube is lifted. About a couple of minutes are required to lower and lift the tube, which brings about fifty gallons of oil to the surface each stroke. When the supply begins to grow thin, boring is again resorted to. The wells are never torpedoed, because the borers are almost sure to reach a fresh supply lower down. On attaining the surface the oil runs through wooden pipes to channels outside the derrick, whence it makes its way to ponds. These, as often as not, are simply natural hollows in the ground with a rough sand embankment around them. After standing a while to rid itself of the sand, the oil is pumped into iron reservoirs, and then is piped to the refineries, eight or ten miles distant at Baku. Some of these ponds are so large as to merit the appellation of lakes. They often contain many million gallons, wasting their goodness on the desert air. The whole expanse of the Balakhani plateau is dotted with them.

At present there are eight pipe lines in operation conveying the oil from the wells to the refineries. The aggregate length of these is over sixty miles. They are quite a modern institution, having only been introduced by Nobel Brothers during the last few years. Previous to that, the oil used to be conveyed in barrels down to the coast.

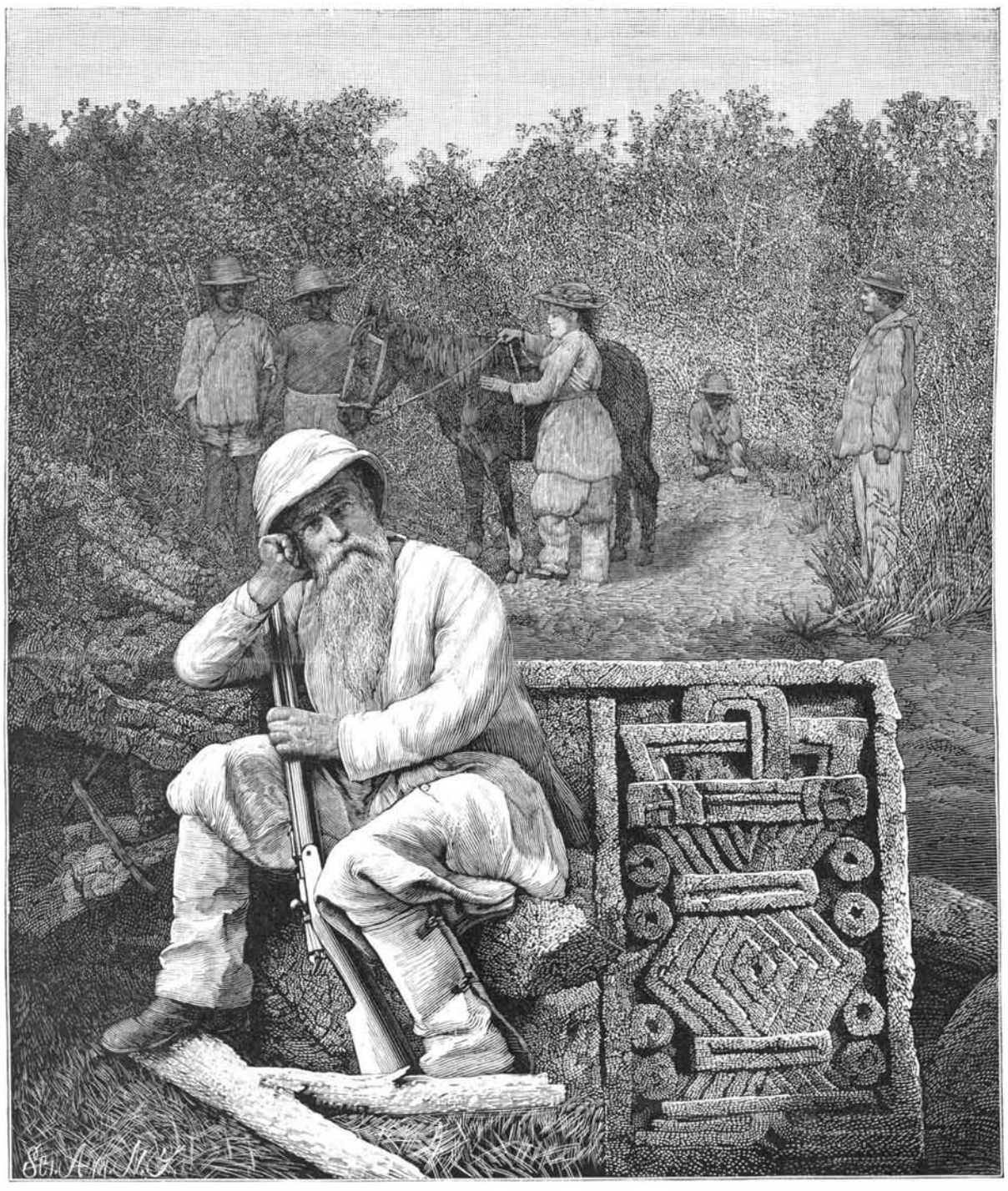
Various schemes are constantly being discussed for conveying the oil to Europe. One of these, in favor several years ago, was a pipe line a thousand miles long, to run from Baku across the Caucasus to the railway system in Southeast Russia. Another extended from Baku to the Black Sea to Poti or Batoum. This may be regarded as the most practical, and if any pipe line ever be laid down from Baku, this will inevitably be the one. At present there is a deal of talk of running a pipe line from Baku to the Persian Gulf, with the idea of securing Baku the exclusive control of the markets of Asia.

The refining operations are carried on at what is known as the Black Town (*Tchorni Gorod*) at Baku, which was illustrated in SCIENTIFIC AMERICAN a few weeks ago. Baku is situated on a magnificent bay, with deep water close inshore. An island, lying across the mouth, serves as a breakwater, and renders the bay safe for shipping in the roughest weather. It is hardly necessary to remind the reader that the southern part of the Caspian is never frozen over, as is the case with the ports at the mouth of the Volga. From the Shakhoff peninsula to Sultan Point the Bay of Baku has an extent of nearly fourteen miles of waterside, of which more than six miles are already taken up by the Black Town, Baku itself, the quarantine port, and the dockyard. The Baku section is fronted by more than a mile of limestone quaying, reminding one of the Thames embankment. Handsome buildings and well stocked shops are rising along this quay, at the back of which extend the best quarters of the town, the old Persian fortress, the municipal offices, and the numerous native bazaars. South of it is the quarantine port, with numerous piers, where the steamers unload their cargoes from the Volga and the ports of Persia. An astonishing amount of trade is transacted here. Beyond lies the handsome dockyard, a very extensive establishment more adapted for the maintenance of a regular fleet than the insignificant gunboat flotilla Russia now keeps up in the Caspian Sea. This, and the stone barracks of the garrison, etc., complete the southern side of the bay.

The northern side is taken up with the railway terminus and wharf and the 200 refineries, the latter of which form quite a town of themselves. As the name implies, the Black Town is a filthy, dirty hole, consisting of greasy stone buildings, surrounded by high stone walls and divided, the one property from the other, by regular quagmires of mud and oil. From nearly all of the refineries dense clouds of smoke rise and blacken the atmosphere. Nobel Brothers' establishment is about the last along the bay, from Baku, excluding two or three others lying some distance away from the Black Town, farther in the direction of Shakhoff Point.

From our brief description it will be seen that Baku is a very extensive town with a large population, and possesses all the resources of civilization. An idea of its shipping may be formed from the fact that 7,000 vessels enter and leave the port every year. Passenger steamers run regularly between it and the towns on the Volga, particularly to Tsaritzin, of which point we give a view showing Nobel Brothers' vast depot.

The distance from Baku to Astrachan, at mouth of Volga, is 560 miles, and from Astrachan the product is transported up the river to Tsaritzin, whence it is carried by rail to the interior of the empire.



DR. LE PLONGEON AND HIS PARTY.

Marble Pictures.

Dr. Hand Smith has been engaged in studying the movement of colored particles within marble, ivory, and other dense substances; and the result is a process of developing paintings and designs below the surface of marble, thereby combining the two arts of painting and sculpture. Through the use of metallic oxides, worked in a special medium and fixed by a special treatment, designs in every shade and tint are produced within the stone. It is a peculiarity of the method that every hue penetrates at right angles to the surface without spreading laterally. Samples of the new art are now being exhibited at Piccadilly Hall, London, and include decorative designs and delicate paintings of autumnal foliage. The process will be applicable to statuary, pottery, and mural tablets, as well as architectural decoration.

DR. LE PLONGEON AND HIS PARTY.

The interesting architectural remains of Yucatan which have been illustrated in the past few numbers of the paper testify so clearly to the civilization and taste of peoples and races who were extinct before this country was discovered, and have elicited so much attention from all who are at all interested in architecture as an art and archæology as a science, that we give in the accompanying engraving portraits of Dr. and Mrs. Le Plongeon, who have for ten years been occupied in prosecuting these researches in the forests of Chichen Itza, and to whom much praise is due for their untiring effort and indomitable perseverance. Dr. Le Plongeon is seated in the foreground, with his head resting wearily upon his hand. Mrs. Le Plongeon, who has accompanied the worthy doctor in all his wanderings is represented in the middle of the picture, ready to mount her Indian pony. Two native attendants stand at the left of the picture by the pony's head, and Lieutenant Alcoeer, chief of the escort, stands at right of the group. In the foreground is seen a curious symbolical stone which had its meaning among the Maya priesthood, and which was discovered in a mound near the monument of Chaacmol.

Cure for Nitric Acid Burns.

Prof. A. Irving writes as follows to the *Chemical News:* Some weeks ago, in experimenting with "brown fuming nitric acid," I happened to splash a portion of this powerfully corrosive liquid upon the skin of the face. The pain caused, I need hardly say, was very acute, and in a few minutes an enormous blister arose upon the part affected. Copious application of cold water, then of such powerful bases as ammonia, potash, and lime in water, had no perceptible effect upon it, except perhaps to increase the violence of the inflammation. After a few minutes, however, I luckily bethought me to try the effect of a dilute solution of sulphurous acid, of which I had a good supply made but a short time previously. Assuming that the action of the strong nitric acid was an intensified process of oxidation, I cast about for a reducing agent which might safely be trusted to be innoxious, even if it did not afford much relief. The effect of its application was astounding. In a very few minutes the blister was reduced; the oxidizing process of the strong acid was completely arrested, without having reached the roots of the hairs on the face; the painful irritation was completely removed, and in an incredibly short space of time the wound healed.

Submarine Electric Lamp.

Recently, some very interesting experiments in submarine electric lighting were conducted on the Clyde, at Greenock, Scotland. The Tilly, a vessel built by Messrs. Hanna, Donald & Wilson for the fisheries at Batavia, has been fitted with machinery to supply current for a 15,000 candle power lamp, which it is intended to lower into the sea for a depth of ten fathoms or less, as the exigencies of the drift net fishing require. The whole of the electrical apparatus, as well as the gearing for raising and lowering the lamp, have been supplied by Messrs. Paterson & Cooper, the current being supplied by one of their No. 4 dynamo machines, coupled directly to a Gwynne high speed vertical engine, and running at 650 revolutions a minute. The lamp, which is inclosed in a flint glass cylinder 9½ inches diameter, is suspended from a davit over the vessel's side, and the two conductors consist of finely stranded copper cord inclosed in India rubber hose. These conductors pass over pulleys on the end of the davit, and the lamp is raised or lowered by a winch fitted to the bottom of the davit. The trial lasted for four hours, during which time the lamp was submerged, and kept alight with the full current of 60 amperes through it.

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The Artificial Alizarine Patent.—An Important Decision by the Supreme Court of the United States.

Justice Blatchford recently delivered the opinion of the court in the appeal case resulting from the suit of the Badische Company *vs.* Cochrane *et al.* This was a suit in equity brought in the Circuit Court of the United States for the Southern District of New York by Badische Anilin und Soda Fabrik, a corporation organized under the laws of the Grand Duchy of Baden, in the Empire of Germany, against the appellants, for the infringement of reissue letters patent No. 4,321, granted to Charles Graebe, of Frankfort-on-the-Main, and Charles Liebermann, of Berlin, Prussia, April 4, 1871, for an improvement in dyes or coloring matter from anthracine. The original patent (No. 95,465) was granted to the same persons October 5, 1869, for an improved process of preparing alizarine. It was reissued on two separate amended specifications, Division A and Division B. No. 4,321 is Division B.

The Judge says:

"Inasmuch as the defendant's article is produced from anthracine, or its derivatives, by some method, and is a dyestuff called 'artificial alizarine,' it is contended that the sale of it infringes No. 4,321. The articles in market, called 'artificial alizarine' at the present day, are substances all of which are made from anthracine; but they vary all the way from nearly pure alizarine made by the monosulpho acid process through the products of the bisulpho acid process, which contain combinations of alizarine and anthrapurpurine, up to an article of pure purpurine, free from alizarine. All of these are used as dyestuffs, according to the shade of color and other qualities desired. The specific article put in evidence in this case as an infringement contains about sixty per cent of anthrapurpurine. It is claimed by the plaintiff to be the artificial alizarine described in No. 4,321, and to be physically, chemically, and in coloring properties similar to that. But what that is is not defined in No. 4 321, except that it is the product of the process described in No. 4,321. Therefore, unless it is shown that the process of No. 4,321 was followed to produce the defendant's article, or unless it is shown that that article could not be produced by any other process, the defendant's article cannot be identified as the product of the process of No. 4,321. Nothing of the kind is shown. On the other hand, the defendant's article is made abroad and by a process different from that of No. 4,321. It therefore cannot be the product of that process. If the words of the claim, 'by any other method which will produce a like result,' mean any other method which will produce the only product mentioned in the description, namely, alizarine, as then understood, having the formula $C_{14}H_8O_4$, the defendant's article is not that product, for it contains other dyeing ingredients which the alizarine of the patent does not contain. If the words of the claim are to be construed to cover all artificial alizarine, whatever its ingredients, produced from anthracine or its derivatives by methods invented since Graebe and Liebermann invented the bromine process, we then have a patent for a product or composition of matter which gives no information as to how it is to be identified. Every patent for a product or composition of matter must identify it so that it can be recognized aside from the description of the process for making it, or else nothing can be held to infringe the patent which is not made by that process."

In brief, the Supreme Court holds as follows:

The claim in reissue letters patent No. 4,321, granted to Charles Graebe and Charles Liebermann, April 4, 1871, is: "Artificial alizarine produced from anthracine or its derivatives by either of the methods herein described, or by any other method which will produce a like result." Unless it is shown that the method described in this patent was followed to produce the defendant's article, or unless it is shown that that article could not be produced by any other process, the defendant's article does not infringe the patent.

While a new process for producing the old article (alizarine) was patentable, the product itself could not be patented, even though it was a product made artificially for the first time, in contradistinction to being eliminated from the madder root. Calling it "artificial alizarine" did not make it a new composition of matter, and patentable as such by reason of its having been prepared artificially for the first time from anthracine, if it was set forth as alizarine, a well known substance.

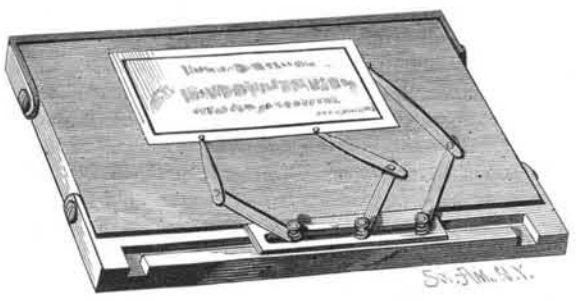
The reissue patent certainly is for a different invention from that described in the original patent, unless the product claimed in the reissue is precisely that product, and no other, which the process described in the original patent produces.

A Magnificent Palace Car.

The private coach recently built for Mr. E. H. Talbot, of the Chicago *Railway Age*, is one of the most luxurious affairs, says Mr. Pullman, ever put upon a railway track. It runs on twelve wheels, six of which were made in Germany by Krupp. The observation room at the end of the car is finished in oak, with plate glass windows extending to the floor, velvet carpets, and embossed leather furniture, including sofas. The bedroom is finished in maple and amaranth, and opening from it is the parlor, the most elegant apartment of the car. It is finished in solid mahogany, with inlaid panels and carvings of rare and costly woods from all corners of the earth, including the Holy Land. The butler's pantry, kitchen, and the sleeping apartments for the servants are models of elegance and comfort. To duplicate the car would cost $75,000—it was a present to Mr. Talbot.

FEED GUIDE FOR PRINTING PRESSES.

Secured by thumb screws and adapted to be shifted along a slot are three fingers made of thin, flat spring metal. To each finger is attached an extension by a joint connected by a small thumb screw having a pointed end. On the outer end of each extension there is a point; these points are set in the tympan sheet at the edges of the paper as shown in the engraving, and the points at the joints are set wherever they may happen to touch, to stay the end points. From the



SMITH'S FEED GUIDE FOR PRINTING PRESSES.

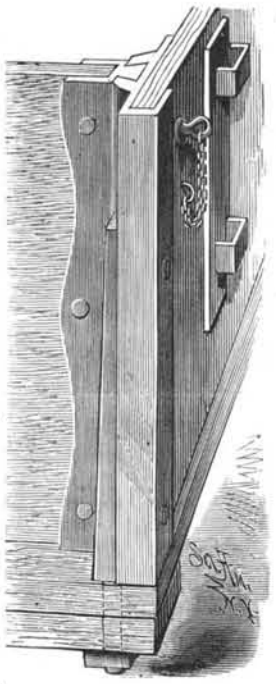
joints the fingers spring downward a little in order to press the end points down.

The attachment needs no screw driver or wrench for adjusting it, as the joints are secured by small thumb screws; the fingers spring sufficiently to allow the points to be raised and carried around, and to keep them pressed down.

This invention has been patented by Mr. W. B. Smith, of Orlando, Florida.

WAGON BODY.

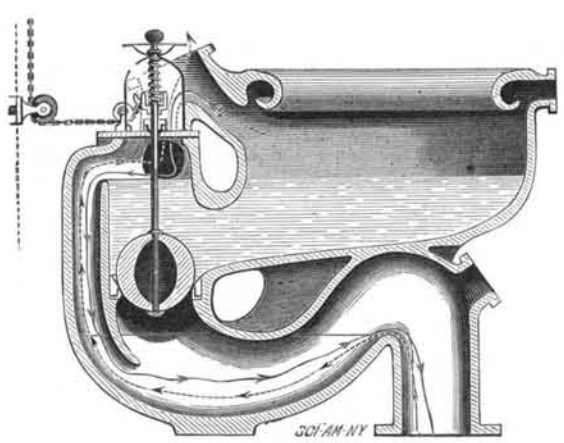
At each corner of the bottom of the wagon box is secured a standard, having a U-shaped cross section, provided with a short and long shank between which pass the ends of the lower side board. Riveted to the outer surface of the long shank is a metal bar which terminates in a screw that passes through the bottom board and a cross bar, and receives a nut. By this means the standard is held in place. On the outer surface of the long shank is formed a dove tailed groove, in which fits a tongue formed on a U-shaped casting held on the end edge of the end board. A locking pin passes through the side board and long shank into the edge of the tongue. The side board is held to the standard by pins. The lower side board is provided with loops for receiving stakes for holding the upper side boards. As the standards hold the end board, no cleats need be nailed to the end of the side boards for holding the end board, neither are cleats on the end board necessary.



This invention has been patented by Mr. C. F. Folsome, and further particulars may be obtained from Messrs. Folsome & Dillon, of Atoka, Indian Territory.

WATER CLOSET.

The accompanying illustration represents one of the latest inventions in water closets, and which is worthy of study, as the inventor claims that it contains all the elements of success needed to make it perfect. It is made of crockery,



WATER CLOSET.

and is simple in operation and compact in form, having no parts where matter can lodge. Raising the pull rod lifts the hollow rubber ball on its lower extremity, and pulls the chain admitting the water, which, as the engraving shows, is not permitted to immediately enter the body of the bowl, but is guided round the crown so that every portion is thoroughly washed. The rod passes through a stuffing box in a brass plate, so that all foul gases are excluded from the room. The rubber ball cushions on a brass thimble cemented to the crockery and finished to a smooth surface with a tool. By means of an encircling spring near its upper extremity, the force required to raise the rod can be adjusted to a nicety, adapting its use to children or adults, as may be necessary.

Particular attention has been paid to ventilation. Emanations from the sewer pass to the lower water line, which bars their further progress. If from any cause this trap should fail to seal, then the gases would take the direction shown by the dotted line, and pass out through the pipe attached to the side of the top of the bowl. In case of siphonage from the exterior, the air would enter the bowl and go through the closet as indicated by the noted line to the sewer. The coupling for uniting the metal pipes to the crockery of the bowl consists of an externally threaded ring, divided into longitudinal sections, which is put round the branch of the bowl. The ring is slightly larger than the collar of the branch, in order that the screw nut which holds the parts together may pass over. The screw nut of the coupling screws on to the split ring, bringing the parts together against a rubber packing.

Communications relating to this patent should be addressed to the Nason Manufacturing Co., 71 Fulton Street, New York.

The Indicator Diagram of a Gas Engine.

At the last meeting of the Physical Society a paper was read by Professor W. E. Ayrton, F.R.S., and Professor J. Perry on the above subject. It was intended to teach practical engineers a method of studying gas engine diagrams. The most recent results obtained by the use of Dowson gas were given by the authors, and it was suggested that before long gas engines will be employed for the propulsion of ships. A large wooden model of an Otto engine enabled the operations going on during a cycle of the engine to be understood by the meeting. Tables were given of the constituents of coal gas and Dowson gas and the air required for combustion, and the heat of combustion and specific heats, to enable the characteristic equation of the fluid used in the gas engine to be determined.

An easy method of obtaining an empirical formula to represent all the diagrams which can be obtained from an engine with different quantities of gas was described, and its results compared with observation. The effects of vibration of the indicator spring in the various parts of the diagram were discussed, as well as those of the explosion. Three practical methods for determining the rate q of gain of heat by the fluid during the forward stroke were given, and a diagram was shown in which this rate could everywhere be compared with the rate of doing work. If W is the indicated work in one cycle, it was shown that 5·64 W is the total energy of combustion of one charge, and this is expended as follows: 1·45 W is the work done in the forward stroke, 2·22 W is given to the cylinder by radiation in the forward stroke, 1·5 W is carried off through the exhaust pipe, 0·47 W is given to the cylinder as heat after the exhaust valve opens. The rate at which the loss 2·22 W by radiation occurs at every point of the forward stroke was shown on a diagram obtained from a knowledge of the temperature at every point in the stroke, and when the ordinates of this diagram were added to the q diagram previously described, a diagram was obtained showing at every point of the stroke the rate at which combustion was going on. This diagram was specially important as showing the effect of dissociation in the gas engine.

Large Grape Vines.

Capt. W. G. Phelps has a grape vine that is now believed *to be the largest in the United States. In 1867 the large* vine that was famous in Southern California was cut down and exhibited at the Centennial Exhibition. It measured 14 inches in diameter. This vine of Captain Phelps' is 25 years old and is 13 inches in diameter. It is of the Mission variety, and it has never received the benefits of irrigation. It stands near the house, south of Stockton about two miles, and it covers about 4,000 square feet of ground. If it had been permitted to run where it wished it would have covered a much larger area, but it was found necessary to cut it back in order to save the roof of the house. The largest crop that grew was two or three years ago, when, after selling a ton and a half by actual weight, the remainder was estimated at two tons and a half.—*Pacific Rural Press.*

(In the *Bulletin of the Torrey Botanical Club* for January, 1882, Prof. C. E. Bessey reports finding in Wayne County, Ohio, a colony of grape vines, supposed to be *Vitis labrasca*, L., the trunks of which were, some of them, over a foot in diameter. In a subsequent number of the same journal, Mr. H. W. Ravenel, of Bluffton, S. C., states that in March, 1881, while in Darien, Ga., he rode out to Baisden's Bluff on the coast, some twelve miles northeast of Darien, to see a celebrated grape vine. It was just in leaf, and, from the wood and bark, appeared to be *Vitis æstivalis*. On measuring the trunk at 8 feet from the ground, Mr. Ravenel found that it had a circumference of 44 inches. This rather beats the grape vine of the land of the "big trees." Another large vine, although of smaller dimensions than those noted above, is reported by Mr. N. L. Britton (*l. c.*) as growing near Egbertville, on Staten Island, N. Y. This vine (*Vitis cordifolia*) has a circumference of 25½ inches at a point three feet above its base, "completely covers three cedar trees, each at least 30 feet high, and is a very beautiful plant.")

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ENGINEERING INVENTIONS.

A balanced slide valve has been patented by Mr. William G. Smith, of New York city. Steel plates are interposed between the tops of the parts of the valve and the tops of the valve boxes, so arranged as to protect the top of the valve from steam pressure, the wear being taken up automatically, and the friction being lessened.

A railway joint and nut lock has been patented by Mr. William M. Jenkins, of Defiance, Iowa. The invention provides means for locking nuts upon bolts used at rail joints, and at the same time hold the fish plates against the webs of the rails with yieiding pressure, thus making a yielding joint, but so the nuts cannot turn of their own accord upon the bolts.

A car coupling has been patented by Mr. Thomas E. Buckman, of Jacksonville, Fla. This invention covers a coupling which operates automatically to couple cars and then lock the coupling, while, when they are to be uncoupled, a hand lever, which extends to the side of the car, may be swung into position to effect this, and locked.

MECHANICAL INVENTIONS.

An adjustable nut bearing has been patented by Mr. George Edmonds, of Brooklyn, N. Y. The invention provides for such special construction of nut bearings that the wear can be taken up and rattling prevented, preventing the more expensive parts of the bearings from wearing out, and especially adapted for drop-stay coupling, king bolts, top props, axles, cocks, faucets, etc.

AGRICULTURAL INVENTIONS.

A horse hay fork has been patented by Mr. Joseph S. Gochnauer, of Abbottstown, Pa. The object of this invention is to improve the construction of horse hay forks hitherto patented in such manner as to make them more convenient and reliable.

A grain measuring machine has been patented by Messrs. Joseph and Andrew Nafziger, of Hopedale, Ill. This invention covers a novel construction of measuring device for grain, adapted to be attached to and operated from the separator of a thrashing machine for automatically measuring the grain as it is thrashed.

A combined cotton scraper and chopper has been patented by Mr. Columbus J. Morrison, of Hawthorn, Fla. This invention covers a special combination and arrangement of parts to facilitate the scraping and chopping of cotton plants in bringing them to a stand, and one which is effective to shave or scrape off the top soil and the grass and weeds, and reduce the row of plants to the desired width.

MISCELLANEOUS INVENTIONS.

An envelope opener and paper cutter has been patented by Mr. Charles E. Hochstetter, of Kansas City, Mo. This is a simple device, of novel form, suitable to carry in the vest pocket, or for use at a desk.

A pin tag has been patented by Mr. Oscar J. Cohn, of New York city. This is a cheap, practical, and durable fastener, made of one piece of wire, but having two points, for attaching and holding tags to goods.

A weather board gauge has been patented by Mr. Dwight H. Finch, of Aurelia, Iowa. This is a simple and easily worked device of novel construction, to facilitate the operation of weather boarding buildings.

A bobbin winder for sewing machines has been patented by Mr. Henry M. Dixon, of New York city. This invention facilitates the winding of bobbins and provides a mechanism for cutting the thread automatically when the bobbins are filled.

A device for attaching and detaching horses has been patented by Mr. Cicero C. Ferrill, of Shubuta, Miss. It is intended, by this invention, to make it possible to dispense with the ordinary harness excepta collar and a pair of hames.

A back strap check hook for harness has been patented by Mr. William N. Wilson, of Shippensville, Pa. This invention consists in providing the back strap with a check hook for holding the check rein, and combining the check hook with the back strap buckle.

A clasp for traveling bags has been patented by Mr. William J. Large, of Brooklyn, N. Y. This invention consists of a spring clasp made of a single piece of metal, with suitable stops or detents for holding the clasp in open and closed position.

A padlock has been patented by Mr. Chas. W. Judson, of Terryville, Conn. It is made in a way not likely to get out of order, is economical, and calculated to afford much greater security than locks of this character heretofore used.

An end cap for paper rolls has been patented by Mr. Frederick W. Dunnell, of Tompkinsville, N. Y. It is a sheet metal cylindrical band, with an inwardly projecting scalloped edge, and with an end fastening to adapt it to be applied to the end of a paper roll.

A paper perforating device has been patented by Mr. Cortland Carlton, of Kalamazoo, Mich. This invention covers novel features of construction in perforating or cutting devices for separating or partially separating paper at the time of printing.

A process for rendering goods and fabrics waterproof has been patented by Mr. Robert S. Forbes, of New York city. The articles are soaked in a waterproofing solution, dried, and then steamed, whereby the solution is fixed on the fibers and the odor thereof removed.

An adjustable shade hanger has been patented by Mr. Julius Wagner, of Silver City, N. Mex. In combination with a rack is a sliding block or carrier, with a pawl for locking it in place, and the shade roller is journaled in two carriers held on racks in opposite sides of the window frame.

A quilting attachment for sewing machines has been patented by Messrs. George O. Houck and Charles Smith, of Springfield, O. This invention provides a new and improved frame for supporting, holding, and adjusting the material to be quilted on a sewing machine.

A folding bathing cabinet has been patented by Mr. Robert A. Horning, of Lanark, Ill. It is made of a folding sack or tube attached to a base board with a perforated sprinkling tube at its upper edge, and can be held raised by lazy tongs, which can be locked in position.

An ale pump and ice box has been patented by Mr. William Gardner, of New York city. This is a simple and economical combination arrangement for best utilizing space and getting all the frigorific effect of the ice in cooling ale, keeping kegs of beer, and such other things as may be desired.

A tag fastener has been patented by Mr. George N. Buck, of Mattoon, Ill. This invention relates to an improvement in the form of tag fastener patented by the same inventor last year, the loop being arranged longitudinally with the plane of the prongs, with other modifications in construction.

A carpet stretcher has been patented by Mr. Russell F. Truslow, of Huntingdon, Tenn. A cam is so made to work on a baseboard lying on the carpet as to extend from itself an arm in which are pins or studs that press into and take hold of the carpet, to stretch it as the cam is turned.

A boot or shoe sole has been patented by Mr. Aaron J. Mott, of Fulton, Kansas. This sole contemplates the use of a metal shank which also extends back for a heel base, and on which a leather heel is fastened, the shank having a scarfed front edge and a hole in the center of the heel base.

A folding cash box has been patented by Mr. Benjamin C. Foster, of Baltimore, Md. It is made in a number of divisions, hinged together and adapted to be folded one upon another, the several boxes being equal in size and depth, and capable of being so folded together that one shall rest horizontally upon another.

A dumping boat has been patented by Mr. Michael S. Coleman, of New York city. It has flat top and bottom, with upper and lower air and water tight compartments on one side, with stern openings closed by lever operated gates, the latter of which can be readily opened and closed, as the boat is turned over for dumping, or held in its upright state with a load.

An oiler has been patented by Mr. Andrew J. Spicer, of Portland, Oregon. The nozzle pipe is made separately from the can, and fitted to slide freely in a stuffing box therein, when pressed in, being normally held out by a spring around it, thus making it easier with a flexible bottom to force out thick or sluggish oil.

A windmill has been patented by Mr. James B. Foster, of Parsons, Kansas. This is a combined windmill with pumping and automatic starting and stopping apparatus, to set the wheel in motion when the water is low, and stop it when the tank is full, the fans being turned edgewise to the wind, or sidewise, by very simple means.

A cuff fastener and adjuster has been patented by Mr. Theodore B. Willson, of Whitewater, Wis. The invention consists of a strip with a shallow right angled bend at one end and a clasp at the other, the clasp to attach the cuff to the sleeve, while the opposite or bent end of the strip is passed through both button holes of the cuff.

A bobbin winder has been patented by Mr. George W. Clapp, of Allemance, N. C. A knife edge of the traversing guide bears on the bobbin, and a tension device on the guide, through which the thread passes with sufficient tension to cause the knife edge to bear on the bobbin, so that thus any size of thread will be automatically guided.

A speed clock for machinery has been patented by Mr. William H. Lord, of New York city. The object is to provide a means for showing the loss or gain in speed of machinery, the clock having a third hand connected by a shaft and gearing with the machinery, and a clock work with two hands, one revolving once an hour and the other once in sixty hours.

A type writing machine has been patented by Mr. Emil J. Hall, of Alexandria, Mo. This invention consists of certain improvements on a type writing machine patented in 1881, by which accidents to the machine cannot so readily happen, even in the hands of careless persons, and the carriage has an automatic catch to secure it in position when raised.

A vehicle wheel has been patented by Mr. Lyman A. Powers, of Bloomington, Wis. This invention consists in certain improvements in the construction of wheels in which the spokes are secured at their inner ends between correspondingly notched hub plates, etc., making a wheel that is light, strong, and durable, for carriages, wagons, and buggies.

A clock has been patented by Mr. Sainteme Diolot, of New York city. Visible hands are dispensed with, and movable figures used instead; there are magnets on the ends of the hands, behind the dial, on which are butterflies or other figures of magnetic material, carried over the dial by the action of the magnets, so the figures indicate the time by their positions on the dial.

A saw jointer has been patented by Mr. Hyman D. Wolcott, of Wright's, Pa. A file holding plate is adapted with a clamp to attach a file, to hold the latter in front of the teeth of a circular saw, the plate being connected to a supporting stock and having an adjusting screw, so the file may be set up to the points of the teeth of the saw, which may be dressed off by running against the file.

An improved horse collar has been patented by Mr. Charles Kiper, of Atchison, Kansas. The rim or front roll of the collar is formed with a throat section made in one piece with the leather of the rim, and bent over and around the lower ends of the shoulder pads, being secured by the same row of stitching that fastens the rim to the shoulder pads, being designed to secure flexibility and make the throat light and strong.

A wagon running gear has been patented by Mr. William H. Fanning, of Lapeer, Mich. Upright frames from the sand boards connect with the axles by braces to support the body, and to the front upright frames are attached platform bars with a plate on their lower sides strengthened by inclined braces, with other features designed to promote convenience and safety in using wagons on farms and rough roads.

A potato parer has been patented by Mr. Gaspar A. Betancourt, of New York city. This invention consists of a closed vessel in which oblate semi-spherical cups, fitting together, are revolved in opposite directions, said vessels having on their inner surfaces numerous projecting burrs, which quickly remove the skins from the potatoes as the latter are tumbled against the burrs by the revolving motion.

An electric bell and annunciator has been patented by Mr. John D. Gilchrist, of Ishpeming, Mich. Combined with the bell is a pointer or dial connected with a weighted block, a lever for locking the pointer in place, and an arm projecting from the armature and adapted to disengage the locking lever from the block, to permit it to swing the pointer so as to show the bell has been sounded.

A robe holder for vehicles has been patented by Mr. George H. Chappell, of Huron, Dakota Ter. The invention consists of an attachment to a sleigh or carriage of presser arms or levers to press the lap robes on the seat by the side of the rider, and also on the bottom of the body of the vehicle by the sides of his feet and legs, to save the rider the trouble of holding them, and increase the comfort of those in the vehicle.

A trunk has been patented by Mr. Edwin Wilson, of Brooklyn, N. Y. The invention relates to means of uniting the top and body of a trunk, and consists in a double valance, one-half secured to the top and the other to the body of the trunk, the two sections being united by a hinge extending the length of the trunk, and so made that when the trunk is closed the two sections enter one within the other, with other special features.

The making of artificial blocks, stones, etc., forms the subject of a patent issued to Mr. Louis Rosenthal, of Frankfort-on-the-Main, Germany. By special combinations and a particular process, using high pressures, stone may be made, by this invention, similar to natural lithographic stone; it does not absorb water, can be polished, requires no treatment in regard to the application of colors, and can be moulded in different shapes.

A fire escape has been patented by Mr. Charles R. S. Curtis, of Quincy, Ill. A carriage is suspended from a drum arranged upon a shaft journaled in the upper part of a building, combined with a piston working in an air cylinder and connected to a drum on the shaft, the connecting ropes of the carriage and piston being wound in opposite directions on the arms, and the cylinder with stop cocks in its upper and lower parts. Lever cams, governed by springs, hold the carriage against guide posts, and regulate its descent.

A side bar vehicle has been patented by Mr. Jackson Taylor, of Newberry, S. C. Two springs are combined in one for each end of the wagon, the individual springs being attached at one end to the rockers of the body, and extended nearly to the other rocker, where they are doubled back and extended in a suitable curve to the side bars on the same side of the body that the upper ends are connected to, the horizontal portions of the springs being clamped together to stay each other.

NEW BOOKS AND PUBLICATIONS.

THE ART OF ORATORY, DELSARTE SYSTEM. From the French of M. L'Abbe Delaumosne and Madame Angelique Arnaud. By Francois Delsarte. Edgar S. Werner, Albany, N. Y.

Delsarte's reputation as a teacher of elocution and oratory, from about 1830 to the time of his death, in 1871, was probably unequaled by that of any other professor of modern times in the same department. He taught Madame Sontag and Rachel, and his ideas of æsthetic oratory were, for a third of a century, the guiding lights of criticism in the most critical capital of Europe. The author in this volume gives us a clearly arranged abstract of the system of Delsarte which cannot fail to be of great value to all readers or speakers ambitious of attaining a high degree of excellence.

A HISTORY OF ELECTRIC TELEGRAPHY, TO THE YEAR 1837. By J. J. Fahie. E. & F. N. Spon, New York and London.

It is only investigators of really solid attainments who are aware how much of a history there is in the long line of research and experiment, before the actual success of the telegraph came as a veritable surprise on the world. To point out the facts in relation thereto, to give due credit to many whose labors have hitherto had but scant recognition, is the leading idea of this volume, whose author, an experienced telegrapher in the British India service, has been for years hunting up the facts and comparing data with a keenness of scent like that of an enthusiastic bibliophile hunting for some rare old print. He hopes to "give the *coup de grace* to many popular errors," and gives authorities to show that "Watson, Franklin, Cavendish, and Volta did not first suggest electric telegraphs; that Galvani was not the first to observe the fundamental phenomenon of what we now call galvanism; that not Daniell, but Dobereiner and Becquerel first employed two fluid cells with membranous or porous partitions; that not Schilling, but Salva first suggested a submarine cable;" with many other statements calculated to attract wide attention in the electrical world.

The catalogue of practical and scientific books published by Henry Carey Baird & Co., of Philadelphia, cannot fail to be of great convenience to any intending purchaser wishing to obtain text books on industrial subjects. It is indexed topically and by authors' names, and for many of the works abstracts of the contents are given. The intelligent and ambitious mechanic of these days, in whatever trade he may undertake, has it in his power to obtain a wonderful amount of assistance from such books as Messrs. Henry Carey Baird & Co. have for several years made a leading specialty, both as publishers and importers.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Solid and Shell Reamers, durable and efficient. Pratt & Whitney Co., Hartford, Conn.

The best evidence in the world of the purity and excellence of Blackwell's Durham Long Cut for pipe or cigarette smoking is found in the fact that the fame of this tobacco increases from year to year. This could not be the case if it were merely "gotten up to sell," or had any dubious or dangerous ingredients in it. Among millions of users of all nationalities, surely some one would find out if it were impure, injurious, or unpalatable. But no, the Durham Bull brand gets more popular, the demand for it wider, and smokers more enthusiastic over its delicious natural flavor.

Wanted.—Patented articles or machinery to manufacture and introduce. C. F. McGill, New Haven, Conn.

Springs. List free. T. F. Welch, 11 Hawkins St., Boston.

For Sale.—Entire right of Pastry Board, a new household novelty free of competition. Write for specification. D. C. Heller, Reading, Pa.

Patent for Sale.—$500 will buy U. S. patent for Clothes Line Holder. J. A. Worley, 117 Laurel St., Cleveland, O.

If you want the best cushioned Helve Hammer in the world, send to Bradley & Company, Syracuse, N. Y.

Steam Gauge making—vacuum, low pressure, and hydraulic; repairing all kinds of makers' gauges. P. O. Box 50, Paterson, N. J.

60 Lathes, new and second-hand, 12″ and 14″ swing, plain and screw cutting. J. Birkenhead, Mansfield, Mass.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

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to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

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"The Sweetland Chuck." See ad. p. 316.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Curtis Pressure Regulator and Steam Trap. See p. 286.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 286.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 301.

Stephen's Vises. Special size for amateurs. See p. 301.

Munson's Improved Portable Mills, Utica, N. Y.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1884 Book of Saws. New matter. 75,000. Free. Address Emerson, Smith & Co., Beaver Falls, Pa.

Hoisting Engines. Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 334.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The Porter-Allen High Speed Steam Engine. Southwark Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Electrical Alarms, Bells, Batteries. See Workshop Receipts, v. 3, $2.00. E. & F. N. Spon, 35 Murray St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Gears.—Grant, 4 Alden St., Boston.—Water motors.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. A. W. asks: 1. Where can I procure ballooning material, and the tools and materials necessary for generating gas? A. The material for a balloon can be obtained through any dry goods house. Chinese silk or, for cheapness, thin, close muslin unbleached. Linseed oil or rubber varnish will do to make the muslin gas tight. 2. What kind of gas is generally used in balloons? A. Make your hydrogen gas with sulphuric acid 1 part, water 4 parts, in contact with iron turnings or zinc scrap in tight barrels, with a hose attached to the bung, leading to a barrel partly filled with water to catch any acid that may pass over, and from the last barrel to the balloon. 3. Where can I get a catalogue of the course of study and discipline of the military school at West Point, and naval academy at Annapolis? A. You may get catalogues by addressing Registrar, U S. Military Academy, West Point, N. Y., and Registrar, U. S. Naval Academy, Annapolis, Md.

(2) F. R. H.—Barytes is used very extensively in the arts, but almost altogether for purposes of adulteration, for which its leading use (about 90 per cent) is in replacing to a greater or less extent white lead in paint. The only other application that we know of is that sometimes it is used as a pigment in combination with certain other bodies.

(3) J. P. P. asks: 1. Is there anything that will toughen timber in seasoning? A. Thoroughly impregnating the timber with creosote or coal tar will increase its density and durability and probably strength. 2. The amount of water that will discharge from a three-quarter inch pipe under a head of 300 to 500 feet; and how much head at the upper end would be required to keep the pipe full, say three-quarters of a mile up the mountain from the discharge? A. We could not advise a three-quarter inch pipe for so great length, as it would become easily obstructed. A pipe 1 inch diameter under 300 feet head would discharge about 9¾ gallons per minute, and under 500 feet head about 13 gallons. You should have a head not less than 2 to 3 feet over mouth of pipe.

(4) E. N. McP. asks: 1. Can I successfully warm a room with hot water, through a radiator or coil, the water heated in a circulating stove or water heater, when the floor of room where the stove is, is but 1 foot lower than the room where I wish the coil? A. Yes. 2. The number of SUPPLEMENT giving information relative to heating by warm water. A. No. 171.

(5) G. R. M. asks the process of coating labels on the back, which, by passing a hot iron over them, makes them stick firmly to satin and other fabrics. A. Probably sugar.

(6) C. R. asks for a receipt for cleaning old files. A. Boil the files in strong soda water to clear the teeth of grease or oil. Then dip in a bath of nitric acid 1 part, water 6 parts, for a few minutes. The time of dipping you will acquire by practice.

(7) J. W. writes: I have two screws, one two inches in diameter, three threads to the inch, and the other six inches in diameter, with three threads to the inch, with the same length of lever, and same amount of power. Is there any difference in the lifting capacity of the two? A. The large screw will sustain double the load of the small screw. There is theoretically no difference in the power required for a given load with equal leverage. With proper and equal lubrication the largest screw has the most friction for equal loads.

(8) M. E. R. asks if there is any danger in keeping a barrel of 150° test kerosene oil, from which oil is taken through a faucet, in the same cellar with a furnace 15 or 20 feet distant from said furnace. A. We doubt if there is any real danger as long as the fire is kept in the furnace and ordinary cleanliness is practiced in drawing the oil. However, if possible, it would be safer to place the tank a little farther removed.

(9) W. B. T.—A six bladed propeller will not be as efficient as a four or three bladed for a steam launch under any conditions, except at very slow speed.

(10) W. L. W. & Sons ask: Is it practicable and economical to attach spiral steam wings to a saw mandrel incased inside a stationary cylinder with supply and exhaust valves operated by cam attachments, thereby dispensing with ordinary engine belting and pulleys? A. It can be done, but very far from being economical.

(11) C. N. H.—Double hulls or catamarans have been built with the inner sides parallel, but they do not work as quickly, and we think they are not as fast as when built in the usual way.

(12) W. J. H.—Using exhaust steam will be most economical, as the back pressure need be but light. You should have a back pressure valve on the exhaust pipe, so that you can regulate the back pressure to just the requirements for heating.

(13) J. B. J. asks: 1. Will a balance wheel give as good results, when the power is given out by belting direct over it, on to a driven pulley, as it will by belting over a separate pulley of equal size, keyed upon the same shaft, other things being equal? A. Yes. 2. Or, does it deprive a balance wheel of any of its advantages to use it as a driving pulley? A. No.

(14) G. A. H.—For tinning light malleable castings: Clean the castings by boiling in caustic soda water to remove all traces of grease. Then dip in clean boiling water to remove the soda. Then dip in a solution of 1 part muriatic acid to 4 parts water, to which has been added a small piece of zinc and sal ammoniac. Have this solution hot; and dry the work on a hot slab of iron before dipping in the tin bath. Sprinkle a little powdered sal ammoniac upon the surface of the melted tin to clear it before dipping. It is supposed that your castings have been thoroughly cleaned from scale by tumbling, as practiced by the malleable iron works. A fresh tumbling in sawdust will make a smooth surface. Any block tin of good quality will do. Banca tin is best; you can get it of the metal dealers in Chicago.

(15) M. L. B. asks whether choke bore guns will shoot shot closer? Will they shoot farther? Are they not more liable to burst, and are they really better and more practical for long range than open bore? A. Choke bore guns will shoot closer. There is greater pressure on the barrel than in open bore, but if properly made there should be no danger. They are more effective for a long range.

(16) L. S. C. writes: Two pumps are lifting water 5 feet high each. One discharges at a velocity of 1,600 feet per minute. The other is enough larger to discharge same quantity of water at a velocity of 100 feet per minute. What percentage more power is consumed with the pump of high velocity? A. You lift the same weight of water to the height in both cases, hence the "work" of raising the water is the same. The increased power required at velocity of 1,600 feet per minute is that due to increased head to produce that velocity and friction, and can only be determined by experiment.

(17) J. D. asks how he can fix plane iron or attachment on same for making curled hard wood shavings for packing vinegar generators? A. You can make the shavings curl by setting the plane iron guard close, or about 1/32 in. from the edge of the cutting edge. Make the bevel upon the guard a little concave instead of convex, as they are purchased. Polish the convex part so that it will roll the shavings easily. Cut away the forepart of plane cavity, to give room for the shavings to curl and free themselves.

(18) N. P. B. asks: 1. Will an electro-magnet, facing and near to a coil of copper wire, develop a current in the coil of copper wire, when a galvanic current is passed around it (the magnet)? If so, what proportion will the inducing current bear to the induced current? A. The current will be generated, but its character and quantity will depend on the strength of the magnet and the diameter of the wire of which the coil is formed. 2. If an electro-magnet develops a certain force on being magnetized, will the same current passed around any number of similar magnets in the same circuit develop an equal force in each as in the one? A. No, owing to the increased resistance thrown into the circuit.

(19) F. D. C. asks (1) if shellac varnish is a conductor of electricity. A. Shellac is one of the best non-conductors of electricity. 2. And if it would serve so when put on wood? A. Yes.

(20) J. F. C. G. asks: 1. Will a horseshoe magnet attract a body sufficient to draw at a distance of from two to four inches, and release it when current is broken, said body weighing from two to four pounds? What size magnet and what battery, etc., would be required? A. A very large electro-magnet would be required to draw four pounds four inches. An axial magnet would probably be better for your purpose than a horseshoe. You would probably need a coil formed of No. 14 wire and having about 400 convolutions. Use ten cells of Bunsen battery connected for quantity. 2. Would an instrument with the above power be dangerous to handle? A. No. 3. Will it work in cloudy, stormy, as well as clear weather, if kept indoors? A. Yes. 4. Will it be sure to act at all times? A. Yes. 5. What I am after is this: I wish to turn a three inch crank one-fourth of a circle when current is established, and when broken, the crank properly weighted will turn back of its own accord. To do this, I thought the horseshoe would be best, but not being acquainted with electrical appliances, I come to you. A. By means of a pawl and ratchet you might be able to accomplish the result with a small magnet if you do not care for instantaneous movement.

(21) J. F.—The current passes always in the same direction in lines as ordinarily arranged, so that no matter which way the message is sent the direction of the current is unchanged. This being the case, the message will always traverse the wire. It is doubtful if there is any direct communication between the ground wires.

(22) F. B. asks: 1. What degree of heat is required in a hatching machine, and if the tank with the heated water is under or over the eggs? A. 104 degrees. The tanks are placed over and under the eggs. 2. I have an Edison 10 candle power lamp; I tried it on two cells of bichromate of potash Grenet battery, but could get no light. Please inform me how I could get a light, and what kind of battery to use. A. You will require 35 or 40 cells of a Grove or Bunsen battery to work your lamps.

(23) J. S. W. writes: 1. I wish to ornament white silk with gold or silver; could I do it in the following manner: Draw the design on the silk with a solution of gold or silver, and then pass an electric current through it? A. We do not think your plan for depositing metals on silk practicable. 2. By mixing the silver solution with that of gold could I obtain the doposited gold in different shades of color? A. You can deposit a gold alloy. 3. What form of battery would be the best to use, and should it be connected for intensity or quantity? A. See SUPPLEMENT, No. 310.

(24) G. B. A. asks: 1. At what point should a steam engine, having say 200 square inches area of piston, and 4 feet stroke, with steam at 60 pounds per square inch, and cylinder well protected by non-conductor, cut off, so that steam may escape at the pressure of the atmosphere? A. It depends on amount of condensation in cylinder and contents of openings and clearances; probably between one-fifth and one-sixth. 2. And approximately, with velocity of piston 400 feet per minute, how much power will such an engine give, leaving friction out of account? A. About 24 horse-power. 3. If the weight of steam so used per minute be multiplied by its temperature minus 212°, at which it leaves the cylinder, and this by 772, and the product be divided by 33,000, will the quotient give the number of horse power of such an engine so run? If not, why not, if 772 feet be the equivalent of a unit of heat? A. No, because much heat is carried off without doing work, and thus lost. The difference between the heat units entering and leaving the cylinder at the end of the stroke × 772 should give the work done.

(25) H. G. asks: How are small metal articles, as hooks, eyes, buttons, etc., to be lacquered or japanned in a practical manner? A. Small articles that can be strung upon a small wire streiched tight, as a bow string, so as to keep the articles from sliding together, may be dipped in thin japan and hung in the oven to dry. Make the bones of stiff wire, and stretch the fine wire, which should be as fine as a thread. If any of the articles run together in dipping, separate them with a small wire after hanging up.

(26) J. S. B. writes: Please accept my thanks for your reply (No. 38, Notes and Queries, April 5) to my queries. In it you state: "The annual mean pressure for Washington for 1879 and 1880 reduced to the sea level was 30·107 inches." Please explain. A. In order to make the barometric observations at all stations comparable in regard to the relative pressure of the atmosphere, a common datum is required. This is found to be what is called the sea level, or mean tide. The datum for Washington and Alexandria is the mean tide level at the respective places minus the height due to the flow current of the Potomac from Washington to the sea. Thus, the requirements of barometric observations all over the United States shall also be accompanied with the height of the barometer above the sea, when the correction is readily made.

(27) Dr. J. C. H. asks: What would probably be the greatest lifting power of a permanent magnet one inch square at ends, and six inches long? A. The lifting power of the magnet depends entirely upon its construction and the material of which it is made. A compound magnet formed of a number of magnets will lift more than a magnet containing the same amount of material in a single bar. The lifting power of a magnet is inversely proportional to the square of the distance. A good compound permanent magnet six inches long should lift twenty pounds.

(28) L. W. D. asks: 1. What would be the cost of deep sea sailing vessels and ships (iron built) of say 1,000, 1,500, and 2,000 tons burden? A. From $80 to $95 per ton, carpenter's tonnage, completely rigged, sails bent, and all outfits ready to receive cargo. 2. Would ink made of galnuts, green vitriol, and gum senegal spoil by freezing? A. We do not think that the ink would be seriously affected by freezing. The following, however, is the formula of an ink that will not freeze: Aniline black, 1 drachm; rub with a mixture of concentrated hydrochloric acid, 1 drachm; pure alcohol, 10 ounces. The deep blue solution obtained is diluted with a hot solution of concentrated glycerine, 1½ drachms, in water, 4 ounces.

(29) W. C. McC.—1. Artificial marble can be made by soaking plaster of Paris in a solution of alum; bake it in an oven, and then grind it to a powder. In using mix it with water, and to produce the clouds and veins, stir in any dry color you wish. This will become very hard and susceptible of a high polish. The process of artificially coloring marbles is too lengthy to be reproduced here, and we refer you to Spons' Workshop Receipts, 1st series, page 391 *et seq.*, where the details are fully given. 2. Extract of vanilla: cut one ounce vanilla into small pieces, and triturate with two ounces sugar to a coarse powder; put it into a percolator, pour on it diluted alcohol until one pint has run through, then mix with one pint sirup. 3. Extract of lemon is prepared by exposing four ounces of the exterior rind of lemons in the air until partially dry; then bruise in a Wedgwood mortar, add to it two quarts deodorized alcohol of 95°, and agitate until the color is extracted; then add six ounces sweet oil of lemon. If it does not become clear immediately, let it stand for a day or two, agitating occasionally. Then filter.

(30) H. C. A. asks for a good whitewash for fences. A. For one barrel of wash: Take half a bushel white lime, 3 pecks hydraulic cement, 10 lb. umber, 10 lb. ocher, 1 lb. Venetian red, ¼ lb. lamp black. Slake the lime; cut the lamp black with vinegar; mix well together; add the cement, and fill the barrel with water. Let it stand 12 hours before using, and stir frequently while putting it on.

(31) H.B. L.—Recipe for marine glue: Try either of the following: 1. Dissolve by heat 1 part of pure India rubber in naphtha; when melted add two parts shellac; melt until mixed. Pour while hot on metal plates to cool; when required to use, melt and apply with a brush. 2. Caoutchouc, 20 grains; chloroform, 2 fluid ounces; dissolve, and add 4 drachms of powdered mastic; let it macerate for a week; must be kept cool and well corked. We do not know of any one who has marine glue already prepared for sale.

(32) W. H. S. asks for the formula for making paste blacking, the same as Bartletts and Miller manufacture. A. We are not familiar with the special preparations mentioned, but an excellent formula for a blacking is given in answer to query 5, in SCIENTIFIC AMERICAN of March 3, 1882. 2. Formula for a shoe dressing for ladies' kid boots, the same as is manufactured so largely in the United States. A. For the dressing, take ¾ pint alcohol; 5 pints white wine; ½ pound powdered gum senegal; 6 ounces loaf sugar; 2 ounces powdered galls; 4 ounces iron sulphate. Dissolve the sugar and gum in the wine. When dissolved, strain, then put it on a slow fire, being careful not to let it boil. In this state add the galls, iron sulphate, and the alcohol, stirring it well for five minutes. Then remove from the fire, and, when nearly cool, strain through flannel, and bottle for use.

(33) W. L.—Gun barrels are made blue by applying nitric acid and allowing it to eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil, and varnish. See also article on Bronze Powder and Bronzing, page 229 of SCIENTIFIC AMERICAN, for April 14, 1883.

(34) C. R.—The best method of preparing "Purple of Cassius" is as follows: Two solutions of tin are required. The first consists of a neutral solution of one part of tin in nitric acid. The second is made by dissolving two parts tin in a mixture of one part hydrochloric acid with three parts nitric acid. A little heat may be cautiously applied toward the end of this process, to prevent any protoxide of tin from remaining in the solution. Next dissolve seven parts of gold in an aqua regia composed of six parts hydrochloric acid, and one part nitric acid, and mix the solution at once with 3,500 parts water; then add the whole of the second tin solution, subsequently by degrees the first tin solution, ceasing the moment the right color is obtained. Its preparation is one of great nicety, and is liable to fail even in the hands of the most experienced. Too little will produce a violet color, too much a brown. Wash the precipitate very quickly, and dry. Stannic chloride is tin perchloride ($SnCl_4$); the stannous chloride is the protochloride ($SnCl_2$).

(35) C. K.—Zinc is cleaned by being passed through a boiling solution of caustic lye, without remaining too long in it, because it may be corroded, and even dissolved; after rinsing it is plunged for a few minutes into water containing from one-tenth to one-twentieth of sulphuric acid, then rinsed in plenty of warm water, and, when necessary, brushed with a stiff brush and pumice stone dust, or scratch brushed.

(36) I. T. E. asks (1) how he can dissolve India rubber for casting rubber stamps from plaster of Paris moulds. A. Rubber can be dissolved in carbon disulphide, benzine, or chloroform, or perhaps best of all in a mixture of methylated ether and petroleum spirit. 2. How is it dissolved, and what kind of rubber is used, and what kind is cheapest? A. Use vulcanized rubber.

(37) J. V.S. asks: 1. What is the rule for finding the proper size and number of square feet of a condenser for a steam engine, both surface and jet? A. The usual proportion for surface condensers is about three-fourths the heating surface of the boiler. Many engineers make it equal or nearly equal to the heating surface of boiler. The capacity of a jet condenser is not a fixed quantity; usually from one-half to three-fourths contents of cylinder. 2. Can you give a recipe for making genuine Farina cologne water, and the so-called Florida water? A. The following is given as Farina's receipt: Dissolve 2 ounces by weight purified benzoin, 4 ounces oil of lavender, and 2 ounces oil of rosemary, in 9 gallons 95 per cent fine cologne spirits. To this solution add successively 10½ ounces each of the oils of neroli, nerolipetit grain, and lemon; 20½ ounces each of the oils of sweet orange peel, limes, and bergamot, together with tincture of rose geranium flowers sufficient to suit the taste. Macerate for some weeks, then fill into flasks. Florida water is prepared by dissolving in half a gallon 90 per cent alcohol 1 ounce each oil of lavender, oil of bergamot, and oil of lemon, and oil of cloves and cinnamon 1 drachm each; add 1 gallon water, and filter.

(38) H. H. asks where he can buy, or what are the ingredients used in preparing a cement or paste suitable for pasting satin on to felt. A. We think either of the following will accomplish your desires: 1. Carbon bisulphide, 4 ounces; India rubber in fine shreds, 1 ounce; isinglass, 2 drachms; gutta percha, ½ ounce; dissolve. The parts must be thinly coated with the solution, which is then left for a few minutes to dry, and finally brought together and pressed out by means of a hot iron. 2. Make a mixture of 2¼ pounds of wheat flour, 2 tablespoonfuls powdered resin, and same amount of fine alum. Add water, and rub to a uniform paste, then transfer to a kettle, heat over fire, and stir until perfectly homogeneous, without lumps. This paste is applied in thin layers over the substances to be united, and pressed with a hot iron.

(39) W. D. S. asks: Is there an instrument made as a guide for the filing of small saws? A. There is no instrument to gauge the filing of a saw; it is the work of skill and judgment. 2. Can a saw be retempered and straightened when it is drawn by heat? A. A saw can be as readily retempered as originally tempered, and be straightened in the usual way, by hammering on the anvil.

(40) W. P. asks: 1. What sort of glass should be used in the construction of the Holtz machine described in SUPPLEMENT, No. 279? Would common window glass do? A. Yes. 2. Would it affect an electro magnet if the iron core itself were made part of the circuit? A. No. 3. How much wire should there be in the secondary coil of an inductorium, which would give one-quarter inch spark? A. It depends on the construction of the coil; try about 200 feet of No. 36. 4. Is gasoline as good as coal gas to burn in a Bunsen burner? Are not the heating effects about the same? A. About the same.

(41) A. M. W. asks: 1. Will an induction coil work an incandescent lamp? A. A very large coil will work an incandescent lamp. 2. If so, how large a coil would it require to work an incandescent lamp of 16 candle power? Please give dimensions of coil required, size of core, diameter of coil, length of coil, size of wire of primary coil, size of wire of secondary coil. How many cells of carbon battery would it take

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to operate above coil, the size of plates being 5x7 inches? A. We do not know that this point has been determined. 3. Would two carbons and one zinc in a battery give better results than a pair, and what should be the thickness of each? A. Two carbons and one zinc are better than one carbon and one zinc; one-fourth of an inch is a good thickness for each. 4. How is the length of a spark of an induction coil measured? A. The length of a spark of an induction coil is the distance between the points from which the discharge takes place.

(42) J. H. asks if a building roofed with iron is any more liable to be struck by lightning than one built of wood. A. An iron roofed building is no more likely to be struck than one of wood. The iron roofed building is the safer if struck; especially so if the roof is well connected with the earth by rods.

(43) G. J. S. asks if lightning would be carried into a house by a copper wire soldered to a copper lightning rod a few feet above ground, so as to form a ground connection for the telephone described in SUPPLEMENT, No 142? A. If the ground to your lightning rod is insufficient, the lightning would probably follow the wire into the house, provided it could find better ground thatway. 2. Would an acoustic telephone work better with brass than with copper wire? A. A light twisted wire cable is said to be the best conductor for the acoustic telephone.

(44) J. W. B. writes: Suppose an endless iron chain should be revolved through a longitudinal helix, charged with electricity from a galvanic battery, would I meet with as much resistance in revolving the chain either way as I would in extracting a straight bar magnet suspended within the same helix? A. The resistance will be less than that of the magnet, but it would still be considerable.

(45) J. M. K.—We do not recognize the kalamein process. If you refer to carbonizing the surface of iron, we think it compares favorably with galvanizing.

(46) H. E.—Electric light carbons will answer for telephone transmitters. The French is the best. Polish the carbons by rubbing them on the finest French emery paper.

(47) J. R. F. asks how he can find the prices for which some of the principal American patents on dynamo electric machines and arc lamp regulators have been sold. A. We know of no means of getting at the prices of dynamo patents. The sum mentioned in the assignments is generally nominal. The real price is a secret.

(48) J. R. W. asks: 1. Is there a self-closing telegraph key in successful operation? If there is, can you give a description of it? A. We are unable to find any self-closing telegraph keys in actual use. 2. Would a key of this kind be of any value if a success? A. It would depend somewhat on the manner in which it operates. We could not tell without seeing a sketch or description of it.

(49) L. C. B. asks what to line silver and nickel plating tanks with, so they will not leak—something that will last? A. Coat the inside with good asphaltum, applied in the melted state. See article on Electro Metallurgy, SCIENTIFIC AMERICAN SUPPLEMENT No. 310.

(50) W. A. R. asks: Why is it that with a steam fire engine you can create a greater pressure in the air chambers than the pressure of steam which is in the boiler? It is a piston engine, with the steam cylinder on one end of the piston, and a plunger pump on the other. And yet 80 pounds steam pressure will work up 150 pounds water pressure. A. Because the steam piston has a larger diameter than the water piston.

(51) W. M.—The method of removing superfluous hair by electrolysis is described accurately in Duhring's Diseases of the Skin, 3d edition, page 425. Dr. J. Magee Finny, of Dublin, has been very successful in using this method.

(52) C. C. B. asks: What causes the report on firing a gun? In a controversy on the point, a man in this shop claimed that it was caused by the air rushing back into the barrel of the gun, and was not made till the air reached the breech on its return. I maintained that the outrush of gas dealt the outside air a blow, projecting the sound waves in advance of it, and that the air did not rush back into the barrel at all, as the barrel is already full of the gas caused by the combustion of the powder, and a comparatively slow change of place, or endosmose and exosmose, takes place between the gas and the outside air. A. It is the blow of the explosion on the air. Your views are correct.

(53) J. W. asks: 1. Does it make any difference as to the amount of wire you use for the secondary coil of an induction coil to obtain a spark? How much battery power for one three inches long? A. Up to a certain limit the more fine wire you use the better; but when the wire of the secondary coil is too far removed from the influence of the primary and its core, the wire becomes useless. One cell of Grenet battery should be sufficient to operate a coil of the size given. 2. Is it necessary to have a commutator for a dynamo machine? A. We know or no practical dynamos that operate without a commutator.

(54) H. D. writes, asking for a little information in regard to lining up a propeller engine shaft; some of us here differ in regard to the right way of finding this out. A. If you know that the cylinder is in line, draw a line through it and down past the shaft; by traveling the crank pin to the upper and lower center, you can see if is true to the line of the cylinder; then to test it at half stroke, draw a line at right angles to the general fore and aft center line, and travel the pin to it.

(55) J. R. J. writes: I wish to make a soft porous paper one-sixteenth inch thick as fireproof as possible, and also make it as hard as possible without destroying porosity. What chemicals or ingredients can be combined, and what proportions, to accomplish my object? A. Paper can be made fireproof by dipping it in a solution of alum and then drying. Newspapers are rendered fireproof by dipping into a solution of soluble glass of 25° Baume, then neutralizing by diluted hydrochloric acid of 10° B. while hot, and drying in the atmosphere. Fireproof paper is generally made by using fireproof materials, such as asbestos. See also SCIENTIFIC AMERICAN for November 10, 1883, and *Journal of Society of Arts*, vol. xxxi., pages 880—96.

(56) C. W. asks whether it makes any difference if the layers of wire used in the primary coil of the "Little Giant Battery" are not wound tightly, and the wires of each layer are very close together. He says he has wound one, using 1 ounce No. 38 silk covered wire. Is this is a sufficient amount to use? A. We do not recognize the "Little Giant Battery" by name. The wires of your coil should be carefully wound. One ounce of No. 38 wire should be sufficient.

(57) H. B. asks (1) how the porcelain that is put into iron kettles is put on. Is a brush used, and then is it put into a kiln and baked? A. Iron ware is enameled with porcelain by first cleaning the surface free from moulding sand, then heating the articles in an oven to a low red in the dark, or what is called a black heat, to slightly oxidize the surface and free it from grease. Then brush the powdered enamel mixed with water, and dry quickly. Then bake with a red heat. 2. How is the porcelain mixed? Is it a powder, and mixed with water or some other liquid? Please inform me how to make the liquid or composition. Also where I can get the porcelain. A. For the second or finishing coat, brush on the glaze coat and treat as the first. For the first coat make a mixture of 66 parts calcined flint ground to a powder, 34 parts borax. Melt these together and pulverize, then add 12 parts potter's clay. Mix the whole with water to the consistency of paint, and apply as above. For the glaze coat take 15 parts borax, 73 parts powdered glass, 12 parts soda. Mix and melt, then pulverize and apply with water. Bake at a red heat.

(58) F. A. L.—The oil of bergamot is obtained from the fruit rind of *Citrus bergamia*, and is extracted by expression. The oil of Portugal is similarly obtained from the rind of the sweet orange, and the oil of canella is procured from the aqueous distillation of the *Canella alba*. Opium is the juice obtained by cutting the unripe rind of the white poppy, and hardened by exposure to the air.

(59) W. P. W.—The following is the formula for Batchelor's Hair Dye: No. 1. To 1 ounce pyrogallic acid dissolved in 1 ounce alcohol add 1 quart soft water. No. 2. To 1 ounce nitrate of silver, dissolved in 1 ounce of concentrated ammonia, add 4 ounces of soft water. Apply each number alternately with separate brushes. The nitrate of silver is worth $1.25 per ounce, and the pyrogallic acid 50 cents per ounce. The remaining ingredients are inexpensive.

(60) D. G. asks: Can canvas be made fireproof, that is, to a certain extent, so it will not ignite from sparks from a boiler used at a portable saw mill? A. A coating of soluble glass will answer, provided it is not exposed so as to be washed off by rain, etc. SCIENTIFIC AMERICAN SUPPLEMENT, No. 245, gives a number of recipes for the purpose of rendering fabrics fireproof.

(61) J. R. M.—For mahogany staining make a madder containing ½ pound of madder, 2 ounces logwood chips boiled in a gallon of water; brush this over the wood while hot; when dry go over this with a solution of pearl ash, 2 drachms to 1 quart of water; size, and polish. The wood is then carefully washed, dried, and polished in the usual manner. The above or in fact any desired stain can be placed outside the rug. A figured border can be put on by means of a stencil, that is, staining or the reverse such parts as are not protected by the plate.

(62) S. O. asks for a good varnish or polish for pianos or finish on furniture. A. Try the following: Put in a bottle 2 ounces gum sandarac, 1 ounce shellac, ½ ounce gum benganium, 1 ounce Venice turpentine, and a pint spirits of wine. Color red with dragon's blood or yellow with saffron. Stand in a warm place till gum dissolves, then strain for use.

(63) D. W. De S. asks for a receipt for sheeting and preparing wax for flowers. A. Wax that is used for modeling is generally the white variety, which is melted and mixed with lard to make it malleable. In working it the tools and the board or stone are moistened with water to prevent its adhering; it may be colored to any desired tint with dry color. To make it into sheets it may be run into suitable moulds.

(64) D. W. W. asks (1) if a dynamo electric machine is not an equivalent of a galvanic battery as electric generator for medical and surgical puposes. A. The current from the dynamo electro machine is substantially the same as that produced by a battery. 2. Cannot one man furnish the power with a dynamo constructed for the purpose, to bring the usual cauterizing electrodes to a white heat? A. It would require rather more than one man power to bring the cauterizing electrode to a white heat. 3. Would not the same dynamo operate a faradic coil with an automatic current breaker precisely as a battery does? A. Yes. 4. What percentage of corn is starch? A. The average quantity in flat American maize is 50½ per cent. In the flat white and yellow varieties 54¾ per cent is obtained. Indian corn contains 67·55 per cent of starch. 5. What proportion of the stock does a distiller succeed in converting, or how much starch remains unconverted? A. The amount distilled is limited only by the quality of the apparatus and perfectness of the method employed. 6. What is the reason for part of the starch remaining unconverted, or what stands in the way of total conversion? A. Theoretically, there is no reason why the entire amount of starch should not be converted, but practically there is always means of loss which cannot be avoided.

(65) J. E. asks: 1. What is the difference between a low pressure and a high pressure boiler? A. The old distinction was that in the low pressure engine the steam was exhausted into a condenser, and in a high pressure engine exhausted into the atmosphere. In the former the pressure of steam was usually from 25 to 40 pounds, and in the latter from 60 to 100 pounds; but the distinction of the two is of late years being worked out, as we have engines working under 80 to 100 pounds pressure which exhaust into a condenser. 2. Also for a work in that line. A. We would recommend to you Roper's Engineer's Handy Book, Haswell's Engineer's Pocket Book, and Perry's Elementary Treatise on Steam.

(66) O. Z. writes: 1. I have made an induction coil according to directions given in one of your SUPPLEMENTS, but instead of using the naked copper wire for the secondary coil. What is the cause? A. Possibly your wire is broken or short circuited. 2. I have constructed a battery on the Grenet principle; but it worked for about two hours, then it failed. A. A Grenet battery is not adapted to continued use. It runs down in a short time. 3. How much battery power would be required to work a small electric light (arc light carbons a quarter of an inch, and incandescent lamp of small size)? A. 20 to 25 cells of Bunsen battery will operate a small arc light. It requires from 40 to 60 cells to run an incandescent lamp.

(67) G. A. W. asks: Which is the strongest (that is, support the greatest weight)—a six inch solid iron column, or a six inch hollow column two inches thick? The length of the columns immaterial. A. The solid cylinder will sustain the greater load.

(68) J. D. B. asks: 1. With what velocity does air move to fill the vacuum created by the passage of lightning? And how fast would it move in a tube previously exhausted? A. The theoretical velocity of air flowing into a vacuum is 1347·4 feet per second. Into an exhaust tube it would flow with about 0·7 of the above velocity. 2. What is the best rule to determine the speed of vessels propelled against or from a current? A. For obtaining the actual speed of a boat in a current, add the velocity of the current to the shore rate when running against the current. Subtract the velocity of the current from the shore rate when running with the current. 3. What degree of heat would friction of the air cause on a smooth surface moving at the rate of 600 feet per second? A. We have no data as to the amount.

(69) W. O. M. asks: 1. Will wood expand by heat? A. We doubt if there is any practical expansion of wood by heat. 2. If water is running over wood, will the wood soak in any of the water? A. Yes.

(70) G. L. F.—For copper dipping solutions use 3½ ounces sulphate of copper, 3½ ounces sulphuric acid, 2 gallons of water. Dip no longer than to obtain a thin coat of copper. If left too long in the dip, the copper will be spongy and muddy, and will rub off. Another plan is to tumble the small work in saw dust wet with the above solution.

(71) E. L. D. asks: What metal will stand the most degrees of heat, and how many degrees it is? A. Platinum has a melting point of 2,600° Centigrade, or 3,080° Fahrenheit. The melting point of iridium may be slightly higher, but practically platinum is the highest-melting element.

(72) J. M.—The great trouble in hardening mill picks, especially the solid picks, arises from unequal heating. More picks are destroyed by overheating the corners than by anything in the nature of the hardening or the bath that they are hardened in. The lowest heat that will harden, in clear water with a little salt in it, is all that is needed. Never plunge the point into the fire, but heat from the eye. Leave the point in the cool part of the fire until the body is hot. If the hardening is well done, the pick should stand well with very little drawing of temper—only to a straw color.

(73) E. F. B. writes: In your SUPPLEMENT No. 425, page 6783, Feb. 23, 1884, is a cut of an incubator heated by electricity. Please tell me if the application is patented; if not, where can a thermometer be obtained with a cut-off attachment? A. The electrical incubator illustrated in the SUPPLEMENT is a German patent. We could not inform you whether it was patented in this country or not without making a search. For further information on incubators, etc., address Perfect Hatching Co., Elmira, N. Y.; A. M. Halstead, Rye, N. Y.

(74) G. V. A.—For gilt lettering upon wood print the letters upon the wood with yellow ink. Then brush gold bronze powder upon the printed work with a fur brush. The bronze will stick to the ink. Hard wood is more difficult to print upon than soft, and may require type of harder metal than ordinary. You may try it with printing type. You can get the yellow ink from a printer, and the gold bronze from a painter.

(75) S. G.—We fear that your photographic lens is of too short focus for a telescope. An object glass of the diameter that you name should be about 3 feet focus. If the lens is achromatic, it will make a very fair telescope if only 2 feet focus. For eye pieces, you will see a full description in SCIENTIFIC AMERICAN SUPPLEMENT No. 399.

(76) E. L. K.—The mounting of a parchment diploma may be done in the same manner as pictures or map work. Upon a clean sheet of paper lay the diploma face down upon a flat table; brush good, clear paste over the back evenly. Upon this lay a piece of thin white muslin a little larger than the parchment. Smooth the muslin down with the hand, and cover with one or two thicknesses of thick wool cloth or a blanket, and press with a flat board and a weight; let it dry over night, then trim the edge for framing.

(77) J. C. H. asks: 1. The number of cubic feet a ton of anthracite coal, chestnut size, should measure? A. For Lehigh coal, 40 cubic feet to a gross ton. For Lackawanna coals 42 to 45 cubic feet per ton. This is for egg size. Add 5 per cent for chestnut. 2. Is there any cheaper material with which ground or flocculent asbestos can be mixed and fashioned into sheets of a firm and stiff consistency, which will form a waterproof composition? And if so, and tanks of the same be made, what substance should be used to cement the laps at the corners? A. Asphalt melted with the asbestos, or shellac varnish makes good waterproof material, as is also paraffine. The first is the cheapest, and will probably give satisfaction.

(78) F. M. writes: I am troubled with using well water, and it is very salty; is there no remedy to make the water soft like rain water? A. We know of no remedy for well water that has salt in it. Water that is hard from lime may be made soft for washing purposes by soda, borax, or ammonia. Such water is not suitable for drinking. If you wish to obtain pure water for drinking, you can make a simple still and condenser. Blow air through the condensed water to make it palatable.

(79) M. L. W.—The stenograph or short hand reporting machine is a French invention, and may have been made in the United States. It has a telegraphic alphabet. Is described in Knight's "Mechanical Dictionary," article "Stenographic Machine." Also back numbers of SCIENTIFIC AMERICAN SUPPLEMENT.

(80) R. H. L. asks where the most strain would come on the steel spokes of an expert Columbia bicycle, above or below the heel?—supposing the rider weighed about 150 pounds, and it being a 54 inch machine—and where when it was without rider? A. The greatest strain or tension upon the wire spokes will be in the same position whether the machine loaded or not, and is supposed to be at an angle of about 25° from the point of contact with the ground.

(81) R. H. K. asks: 1. How he can loosen the shutters on outside blinds without taking the whole thing to pieces? They have been stuck by paint, I suppose. A. If the paint cannot be cut out with a knife, you can take off the whole of the paint with strong potash. We think the only proper way is to take the shutters apart and ream out the holes, and scrape off the excess of paint from the leaves. 2. Also how to prevent a botany box from rusting? A. Clean your botany box thoroughly and paint with Prince's metallic paint and boiled linseed oil, and dry in the sun.

(82) W. J. A. writes: I have heard of a chemical or paint works in New York, in which not one of the employes (it is said) has died of consumption during a space of 25 years; it is also stated that persons going there to work afflicted with lung diseases have been completely cured. A. One of the oldest and largest paint manufacturers in New York thinks he heard some such report as you mention, years ago, about curative effect of work in paint and chemical establishments. He says it was obviously untrue so far as paint business was concerned, and it seemed to him, as it does to us, ridiculous as to chemical works, as it certainly would be if said in regard to white lead, zinc white, sulphuric acid, etc.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. C.—It is impossible for us to give information relative to ingredients of an iron ore, unless it be submitted to chemical analysis. The expense of such an examination would be about $15.00. From the appearance of the specimen received, we would hardly recommend you to have it analyzed.—A. M. F.—The sample is pyrite (iron sulphide) of no apparent value. —R. T. B.—No. 1 is a close grained silicious rock. No. 2 consists essentially of hornblende and mica. The specimens have no value for economic purposes as far as their metallic ingredients are concerned.—J. T. C.—The specimen is pyrite (iron sulphide) of no economic value except in the manufacture of sulphuric acid.—V. W. P.—The specimen is pyrite (iron sulphide). It may carry gold, and an assay costing $5.00 will be necessary to determine the value, if any.—B. A. B.—The specimen is known mineralogically as chalcopyrite. It is a mixture of copper and iron sulphides, and sometimes carries gold.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 13, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Alloys for safes, metallic, J. Farrel..... 298,365
Animal trap, P. R. Erling..... 298,361
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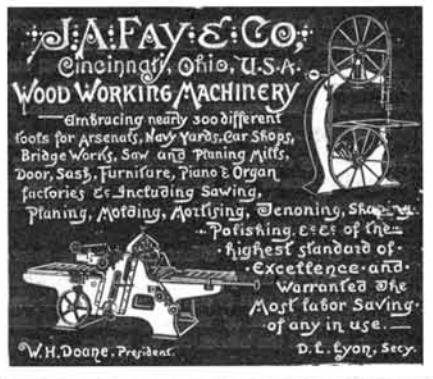

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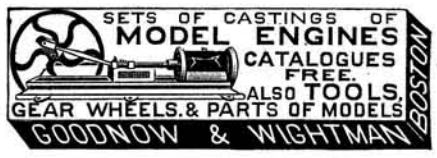

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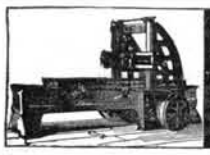

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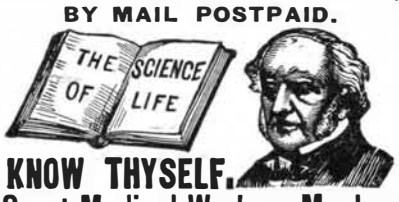

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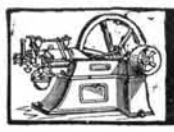

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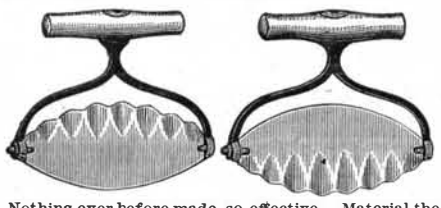

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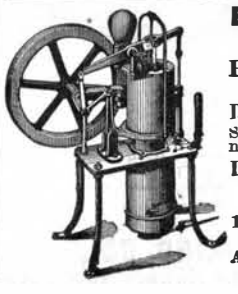

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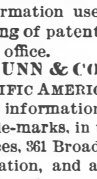

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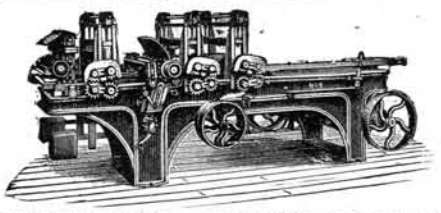

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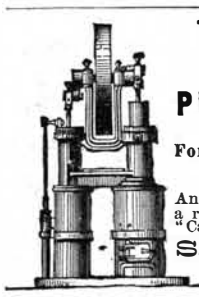

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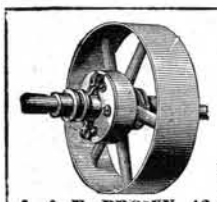

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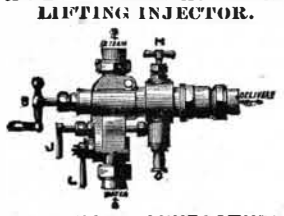

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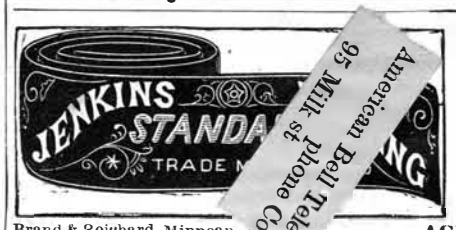

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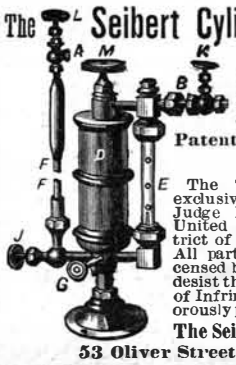

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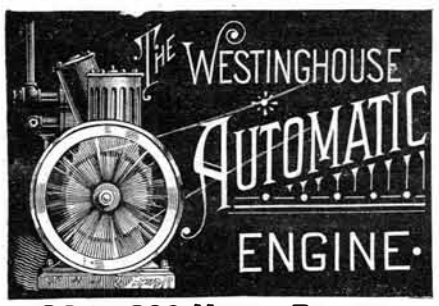

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